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Energy Research Abstracts

Abstracts 27192–28972

Office of Scientific and Technical Information
UNITED STATES DEPARTMENT OF ENERGY

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Energy Research Abstracts

Coverage

Energy Research Abstracts (ERA) provides abstracting and indexing coverage of all scientific and technical reports and patent applications originated by the U.S. Department of Energy, its laboratories, energy centers, and contractors, as well as theses and conference papers and proceedings issued by these organizations in report form. Audiovisual materials, computer media (magnetic tapes, diskettes, etc.), and engineering drawings are included in this definition. *ERA* also covers other energy information prepared *in report form* by federal and state government organizations, foreign governments, and domestic and foreign universities and research organizations, *provided* that the full text of the document has been received by OSTI. Foreign report information is obtained through the International Energy Agency's 16-nation Energy Technology Data Exchange, the International Atomic Energy Agency's International Nuclear Information System, or nation-to-nation agreements. The purpose of this publication is to announce documents produced or obtained by DOE that are not so readily available as journal articles, books, or patents.

Scope

The scope of *ERA* encompasses DOE's research, development, demonstration, and technology programs resulting from its broad charter for energy sources, supplies, safety, environmental impacts, and regulation.

The citations presented in *ERA* are available for online searching as records within the Energy Science and Technology Database (EDB). The current-year records are available on the Integrated Technical Information System (ITIS).

Availability

DOE and DOE contractors can obtain *ERA* (regular issues and annual indexes) by using VISA, MasterCard, or OSTI deposit accounts. Contact the Office of Scientific and Technical Information, P.O. Box 62, Oak Ridge, TN 37831, Attention: Information Services. For further information, call (615)576-8401. *ERA* is also available at authorized GPO Depository Libraries. (List is provided on the inside back cover.)

ERA (regular issues and annual indexes) is available to the public on a subscription basis from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402.

Managing Editor, Doris M. Henline
Technical Editor, Milton O. Whitson

Information Sources

The citations presented in *Energy Research Abstracts* are a subset of the worldwide energy information provided to the Office of Scientific and Technical Information (OSTI) through exchange agreements with foreign sources and through exchanges or contracts with U.S. organizations.

The **Energy Technology Data Exchange (ETDE)** was established by the International Energy Agency to promote cooperation among members in conducting appropriate energy-related research and development programs through the development of a formal central information sharing system. In accomplishing the objectives of the ETDE, members select, abstract, and index relevant research information published in their countries in accordance with Exchange standards. OSTI serves as the central receiving and processing center for this information, which it then disseminates to national centers in the participating countries. The following countries are currently members of the ETDE:

Canada	Poland
Denmark	Republic of Korea
Finland	Spain
France	Sweden
Germany	Switzerland
Italy	The Netherlands
Japan	United Kingdom
Norway	United States

The **International Nuclear Information System (INIS)** was established to promote the exchange of information on nuclear science and technology. Its operation is similar to that of the ETDE, with the INIS Secretariat being located in Vienna, Austria. Currently, 79 countries and 15 international organizations are members of INIS. OSTI serves as the INIS national center for the United States.

In the exercise of its rights and responsibilities under the agreements to which it is a party, the **Office of Scientific and Technical Information** both receives information from the above sources and submits U.S.-produced information to them. In addition to materials generated by the Department of Energy, this U.S.-produced information is gathered from other government agencies as well as under contract with private information processing companies. All input is computer processed and entered into a database for online retrieval. The database serves as well for the production of numerous OSTI publications.

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The principal data elements included in these citations are:

1. **Abstract number** within volume.
2. **Report number** identification for report-type literature.
3. **Title and subtitle** (non-English title may appear in parentheses, if applicable).
4. **Author(s).** First 10 names in the data record are printed, then "et al." is listed.
5. **Author affiliation.** Only first one is listed, in parentheses after author(s) to which it applies.
6. **Collaboration,** if present.
7. **Corporate author(s)** identifying corporation responsible for document.
8. **Date of publication.** If not known, a processing date is in brackets.
9. **Number of pages** or page range. Prices are based on total pages unless special pricing applies.
10. **Language** of document if non-English.
11. **Monograph title** if citation is an analytic (part, chapter, or paper) of a larger monograph.
12. **Sponsoring organization.**
13. **Contract or grant number.**
14. **Secondary identifying number;** may be a conference number.
15. **Conference title, location, and date,** if applicable.
16. **Order number.** The "DE" order number may be used for ordering from NTIS or OSTI, as appropriate. The "TI" prefix is valid only at OSTI.
17. **Sources of availability** from which a copy of the document may be obtained; usually appear as abbreviations. (See information on following page.)
18. **Drop note** or explanatory statement.
19. **Abstract.**
20. **Subject descriptors.** Listed only if no abstract or only a brief statement is included.

Sample Citations

Report

18494 (DOE/ER/40438–T1) **[Development of a hydrogen and deuterium polarized gas target for application in storage rings]: Progress report.** Haeberli, W. Phys. VI collaboration. **Wisconsin Univ., Madison (USA). Dept. of Physics.** [1989]. 12p. Sponsored by DOE Energy Research. DOE Contract FG02-88ER40438. Order Number DE89007246. **Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.**

This paper briefly discusses the Wisconsin test facility for storage cells; results of target tests; the new UHV...

Report Analytic

18500 (INIS-SU—69, pp. 30-32) **Transition energies in Ne-like ions. Correlation effects.** Vainshtejn, L.A. AN SSSR, Moscow. Fizicheskij Inst. 1988. (In Russian). In *Experimental and theoretical physics. Collection.* Order Number DE89780060. Available from NTIS (US Sales Only), PC A03/MF A01; INIS.

Kratkie Soobshcheniya po Fizike.; no. 6.

SILVER IONS/energy-level transitions; XENON IONS/energy-level transitions; CORRELATIONS; D STATES; E STATES;...

54 (DOE/ER/60888-1-Vol.1, pp. 115-117) **Investigation of air pollution in house due to use of various fuels.** Luo, Dayu (Chengdu Sanitation (China)). Canada Mortgage and Housing Corp., Ottawa, ON (Canada). 1990. (CONF-900724-Vol.1: Indoor Air '90: 5th international conference on indoor air quality and climate, Toronto (Canada), 29 Jul - 3 aug 1990). In Indoor air '90: The fifth international conference on indoor air quality and climate. Volume 1: Final report. 786p. Order Number DE90017786. Source: NTIS.

Air pollution in houses caused by combustion of coal is more serious than that by combustion of natural gas and methane (primarily by SO_2 and NO_2). The gas concentration after cooking is higher than that before cooking, and it is higher in kitchen than in bedroom and outdoor. There were mutations in the extract from TSP in $30m^2$ air in the bedroom, kitchen and outdoor, where coal and natural gas were used. The supernatant saliva activity of children whose family uses coal is significantly lower than that of pumping streams.

How To Order from the Availability Sources

TO OBTAIN A REPORT

Report literature, usually identified by an alphanumeric identifier at the beginning of a citation, is available from the sources listed in the citation (see example of element 2 on page iii). Often the sources are listed as abbreviations. Corresponding addresses are provided at right from which documents with these abbreviations may be ordered. When "OSTI" is given, **DOE and DOE contractors may order these documents from OSTI.** (However, check with your library or information organization which may require that orders go through them to OSTI.) OSTI prices are based on total pages unless special pricing applies. The public should order from NTIS or from one of the other agencies listed in the citation. NTIS price codes may continue to appear in some records. To expedite processing, an order form is provided in the back of this publication. NOTE: The order numbers provide quicker access for report ordering. Use the order number where possible.

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Government Printing Office
Washington, DC 20402

GPO Dep. Available for inspection or interlibrary loan at Government Printing Office regional depository libraries.

INIS *Available only in microfiche.*
INIS Clearinghouse
International Atomic Energy Agency
P.O. Box 100, A-1400
Vienna, Austria

NTIS U.S. Department of Commerce
Technology Administration
National Technical Information Service
Springfield, VA 22161

OSTI U.S. Department of Energy
Office of Scientific and Technical Information
P.O. Box 62
Oak Ridge, TN 37831

ESTSC Energy Science and Technology Software Center
P.O. Box 1020
Oak Ridge, TN 37831-1020

CASI Attention: Document Order
NASA Center for AeroSpace Information
800 Elkridge Landing Road
Linthicum Heights, MD 21090-2934

How To Use the Indexes

Five indexes are provided for approaching the content of each issue of *Energy Research Abstracts*. Descriptions of entries in these indexes follow.

Corporate Author Index
The corporation, organization, or institution responsible for the issuance of the document is listed in this index. The entries are arranged alphabetically and provide the title and citation number of the reference. For example, the listing for the "Report" sample citation would appear as shown at right.

Wisconsin Univ., Madison (USA). Dept. of Physics
[Development of a hydrogen and deuterium polarized gas target for application in storage rings]: Progress report, 15:18494 (R;US)
Wisconsin Univ., Madison (USA). Lab. of Genetics
Organization of the R chromosome region in maize: Final progress report, June 1, 1983–May 31, 1986, 15:18255 (R;US)

Personal Author Index
Each author's name listed on a document cited in this issue is indexed. An index entry provides title and citation number; for secondary and other names, a cross-reference is given to the primary author name where the full index entry is located.

Hadley, D.L., *See* Lee, A.D., 15:17651
Haeberli, W., [Development of a hydrogen and deuterium polarized gas target for application in storage rings]: Progress report, 15:18494 (R;US)

Subject Index
This index lists the main subject descriptors assigned to each record by indexing professionals. A secondary or qualifier term is used where necessary to describe materials, objects, and processes. Document titles may be enhanced with additional informative phrases where necessary. An excerpt from this index appears at right.

HYDROGEN ISOTOPES
See also DEUTERIUM
HYDROGEN 4
TRITIUM
Neutron-Rich Isotopes
Study on the strong neutron-rich nuclei of lightest elements, 15:18686 (RA;SU;In Russian)

Contract Number Index
DOE technical reports are listed by contract number. Each entry also provides the primary corporation or organization cited for that contract number. A typical entry is shown.

FG02-88ER40438 **Wisconsin Univ., Madison (USA). Dept. of Physics**
15:18494 DOE/ER/40438–T1
FG02-88ER60664 **Rogers and Associates Engineering Corp., Salt Lake City, UT (USA)**

Report Number Index
Technical report literature is indexed by the alphanumerical identifier of the report. Patent documents and conferences are included for convenience. Each entry lists the citation number, the source of availability of the document, an indicator of presence at a GPO depository library, order number, and distribution category. A typical entry is:

DOE/ER/40438–T1 15:18494 NTIS, OSTI E 1.99: DE89007246 MF-411

Subject Contents

The subject content of *Energy Research Abstracts* is arranged as shown below. The two-digit and four-digit category numbers printed here illustrate the category number assignment used in the database records.* The following list includes all of the 38 first-level and the 313 second-level categories. Because each issue of *ERA* publishes citations only for those documents announced during the past semimonthly period, some subject categories may not be present in every issue.

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*The numerical subject category scheme is used in the storage, retrieval, and manipulation of bibliographic information entered into DOE's data systems. Categories and definitions for the complete set of six-digit numbers are given in ETDE/PUB--1-R2, *International Energy: Subject Categories and Scope*.

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Energy Research Abstracts

01 COAL, LIGNITE, AND PEAT

0103 Preparation

Refer also to citation(s) 27222, 27223, 27224, 27225, 27226, 27227, 27228, 27229, 27230, 27231, 27232

27192 (CONF-9107134–5) **Basic principles and mechanisms of selective oil agglomeration.** Wheelock, T.D. Iowa State Univ. of Science and Technology, Ames, IA (United States). [1994]. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-82. From 7. annual coal preparation, utilization, and environmental control contractors conference; Pittsburgh, PA (United States); 15-18 Jul 1991. Order Number DE94014666. Source: OSTI; NTIS; GPO Dep.

The overall objective of this work is to determine the important principles and basic mechanisms which underlie various selective oil agglomeration processes for beneficiating fine-size coal in order to facilitate the technical development and application of such processes to various types of coal. The recent work described herein has involved a more detailed study of the effects of mild oxidation on the surface properties of different types of coal and the relationship between the agglomerability of oxidized coals and their surface properties. In addition, the work has involved developing more effective means for separating coal and pyrite by finding and applying selective depressants for pyrite.

27193 (DOE/FE–0217P(1/94)) **Clean coal technology: The new coal era.** USDOE Assistant Secretary for Fossil Energy, Washington, DC (United States). Jan 1994. 40p. Sponsored by USDOE, Washington, DC (United States). Order Number DE94015886. Source: OSTI; NTIS; GPO Dep.

The Clean Coal Technology Program is a government and industry cofunded effort to demonstrate a new generation of innovative coal processes in a series of full-scale showcase" facilities built across the country. Begun in 1986 and expanded in 1987, the program is expected to finance more than $6.8 billion of projects. Nearly two-thirds of the funding will come from the private sector, well above the 50 percent industry co-funding expected when the program began. The original recommendation for a multi-billion dollar clean coal demonstration program came from the US and Canadian Special Envoys on Acid Rain. In January 1986, Special Envoys Lewis and Davis presented their recommendations. Included was the call for a 5-year, $5-billion program in the US to demonstrate, at commercial scale, innovative clean coal technologies that were beginning to emerge from research programs both in the US and elsewhere in the world. As the Envoys said: if the menu of control options was expanded, and if the new options were significantly cheaper, yet highly efficient, it would be easier to formulate an acid rain control plan that would have broader public appeal.

27194 (DOE/MC/10637–3820) **Preparation and combustion of Yugoslavian lignite-water fuel, Task 7.35: Topical report, July 1991–December 1993.** Anderson, C.M.; DeWall, R.A.; Ljubicic, B.R.; Musich, M.A.; Richter, J.J. North Dakota Univ., Grand Forks, ND (United States). Energy and Environmental Research Center. Mar 1994. 49p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FC21-86MC10637. Order Number DE94004111. Source: OSTI; NTIS; GPO Dep.

Yugoslavia's interest in lignite-water fuel (LWF) stems from its involvement in an unusual power project at Kovin in northern Serbia. In the early 1980s, Electric Power of Serbia (EPS) proposed constructing a 600-MW power plant that would be fueled by lignite found in deposits along and under the Danube River. Trial underwater mining at Kovin proved that the dredging operation is feasible. The dredging method produces a coal slurry containing 85% to 90% water. Plans included draining the water from the coal, drying it, and then burning it in the pulverized coal plant. In looking for alternative ways to utilize the "wet coal" in a more efficient and economical way, a consortium of Yugoslavian companies agreed to assess the conversion of dredged lignite into a LWF using hot-water-drying (HWD) technology. HWD is a high-temperature, nonevaporative drying technique carried out under high pressure in water that permanently alters the structure of low-rank coals. Changes effected by the drying process include irreversible removal of moisture, micropore sealing by tar, and enhancement of heating value by removal of oxygen, thus, enhancement of the slurry ability of the coal with water. Physical cleaning results indicated a 51 wt % reduction in ash content with a 76 wt % yield for the lignite. In addition, physical cleaning produced a cleaned slurry that had a higher attainable solids loading than a raw uncleaned coal slurry. Combustion studies were then performed on the raw and physically cleaned samples with the resulting indicating that both samples were very reactive, making them excellent candidates for HWD. Bench-scale results showed that HWD increased energy densities of the two raw lignite samples by approximately 63% and 81%. An order-of-magnitude cost estimate was conducted to evaluate the HWD and pipeline transport of Kovin LWF to domestic and export European markets. Results are described.

27195 (DOE/PC/90287–T14) **Oxidation of coal and coal pyrite mechanisms and influence on surface characteristics: Technical progress report, December 1, 1993–May 31, 1994.** Doyle, F.M. California Univ., Berkeley, CA (United States). Dept. of Materials Science and Mineral Engineering. [1994]. 13p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG22-90PC90287. Order Number DE94017124. Source: OSTI; NTIS; GPO Dep.

The objective of this research is to develop a mechanistic understanding of the oxidation of coal and coal pyrite, and to correlate the intrinsic physical and chemical properties of these minerals, along with changes resulting from oxidation, with those surface properties that influence the behavior in physical cleaning processes. The results will provide fundamental insight into oxidation, in term of the bulk and surface chemistry, the microstructure, and the semiconductor properties of the pyrite. During the fourteenth and fifteenth quarters, flotation tests were done on Upper Freeport coal from the Troutvill #2 Mine, Clearfield County, Pennsylvania and on coal samples from the Pennsylvania State Coal Bank. The influence of electrode potential on the surface properties of coal pyrite was tested using contact angle measurements on polarized Pittsburgh coal pyrite electrode.

27196 (DOE/PC/91310–T10) **The use of solid-state NMR techniques for the analysis of water in coal and the effect of different coal drying techniques on the structure and reactivity of coal: Quarterly report, March 1, 1994–May 31, 1994.** Netzel, D.A. Western Research Inst., Laramie, WY (United States). [1994]. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG22-91PC91310. Order Number DE94016006. Source: OSTI; NTIS; GPO Dep.

One area for improvement in the economics of coal liquefaction is coal drying, particularly for the lower rank coals. However, there is considerable evidence to show that drying has a detrimental effect on the liquefaction behavior of coals. Regarding the liquefaction of coal, there does not appear to have been any systematic study of the methods of coal drying on coal structure and the role water plays in enhancing or lessening coal reactivity toward liquefaction. For the research program reported here, different methods of drying are being investigated to determine if drying can be accomplished without destroying coal reactivity toward liquefaction. In an effort to understand the mechanism of water for enhancing coal liquefaction yield, the reactions of D_2O with the molecular constituents of coal during coal liquefaction are being investigated. This study involves the use of solution-state deuterium NMR, as well as, conventional solution-state ^1H and ^{13}C NMR analyses of the coal, and the coal liquids and residue from a coal liquefaction

process. These D_2O transfer reactions will be conducted on coals which have been dried by various methods and rehydrated using D_2O and by successive exchange of H_2O associated with the coals with D_2O. The drying methods include thermal, microwave, and chemical dehydration of the coal.

27197 (DOE/PC/92521–T153) **Removal of pyrite and trace elements from waste coal by dissolved-CO_2 flotation and chelating agents: [Quarterly] technical report, December 1, 1993–February 28, 1994.** Shiao, S.Y. (Babcock and Wilcox Company (United States)). Illinois Dept. of Energy and Natural Resources, Springfield, IL (United States). [1994]. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FC22-92PC92521. Order Number DE94016035. Source: OSTI; NTIS; GPO Dep.

In dissolved-CO_2 flotation, ultrafine -bubbles are generated by CO_2 dissolved in water. The ultrafine bubbles have the potential to improve the separation efficiency in fine coal cleaning. Chemicals will be used prior to or during dissolved-CO_2 flotation to improve the separation efficiency-CO_2 of pyrite and other minerals including trace metals from coal. Chelating agent will be applied to clean coal to further reduce the trace metals from coal. During this period, a 3 in. diameter packed column has been purchased and installed. This column was then modified for use in dissolved-CO_2 flotation. Coal samples of Illinois No. 6 coal are being prepared for flotation. Preliminary flotation tests were performed on Illinois No. 6 waste coal.

27198 (DOE/PC/92547–T4) **Controlling of incipient oxidation of pyrite for improved rejection: Sixth quarterly technical progress report, January 1, 1994–March 31, 1994.** Yoon, R.H.; Richardson, P.E. Virginia Polytechnic Inst. and State Univ., Blacksburg, VA (United States). Dept. of Mining and Minerals Engineering. [1994]. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG22-92PC92547. Order Number DE94014515. Source: OSTI; NTIS; GPO Dep.

The major objectives of this work are (1) to determine the Eh-pH conditions under which pyrite is stable, (2) to determine the mechanism of the initial stages of pyrite oxidation, and (3) to determine if the semiconducting properties of pyrite affect its oxidation behavior. It is known that moderate oxidation of pyrite produces a hydrophobic surface product. This hydrophobic product makes it extremely difficult to depress pyrite in coal flotation circuits. The eventual objective of this work is to prevent pyrite oxidation in order to better depress pyrite in coal flotation circuits. In this work clean, unoxidized pyrite surfaces are being produced by fracturing pyrite electrodes in an electrochemical cell. It has been shown that by holding the potential at different values during fracture and measuring the current passed at fracture, pyrite oxidation or reduction can be precisely controlled, or prevented. It has also been found that fresh pyrite surfaces, created by fracture in an electrochemical cell, begin to oxidize at potentials that are about 200 mV more negative than the potentials reported in the literature for pyrite oxidation. This is attributed to the fact that most work on pyrite has employed polished electrodes that have preexisting oxidation products on the surface. Electrochemical reduction and oxidation of these preexisting products essentially mask the oxidation of pyrite itself. In addition, photocurrent measurements show that freshly-fractured pyrite surfaces are charged negatively. This negative charge is believed to result from an intrinsic, acceptor-like surface state. This report period, voltammetric and photocurrent studies have been carried out as a function of pH and the photoresponse of pyrites from different sources have been determined.

0104 Processing

Refer also to citation(s) 27192, 27195, 27229, 27576

27199 (ANL/CHM/CP–83166) **Ion exchange and absorption techniques to apply catalysts for liquefaction of lower rank coals.** Vorres, K.S. (Argonne National Lab., IL (United States)); Cronauer, D.C.; Curtis, C.W.; Brannan, C.J. Argonne National Lab., IL (United States). [1994]. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-940813–12: 208. American Chemical Society national meeting, Washington, DC (United States), 21-26 Aug 1994). Order Number DE94015064. Source: OSTI; NTIS; GPO Dep.

Samples of Beulah-zap lignite, Black Thunder and Wyodak subbituminous, and Illinois No. 6 high volatile bituminous coals have been prepared by acid treatment to remove exchangeable cations. Subsequent treatments were made with solutions of catalytic metals including iron or cobalt or nickel to exchange with the acid sites, or with molybdate to adsorb on the surface. Samples were then subjected to liquefaction conditions in microautoclave tubular microreactors and solvent extraction was used to establish total conversion or yields of oils, asphaltenes and preasphaltenes. Results of the liquefaction experiments are compared with the catalyst loadings.

27200 (ANL/ET/CP–82796) **Ceramic membranes for generation of partial-oxidation products from methane.** Balachandran, U. (Argonne National Lab., IL (United States)); Dusek, J.T.; Sweeney, S.M.; Mieville, R.L.; Maiya, P.S.; Kleefisch, M.S.; Pei, S.; Kobylinski, T.P. Argonne National Lab., IL (United States). May 1994. 16p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-940813–13: 208. American Chemical Society national meeting, Washington, DC (United States), 21-26 Aug 1994). Order Number DE94015075. Source: OSTI; NTIS; GPO Dep.

The most significant cost associated with partial oxidation of methane to syngas is that of the oxygen plant. In this paper, we offer a technology, based on dense ceramic membranes, that uses air as the oxidant for methane-conversion reactions and eliminates the need for an oxygen plant. Certain ceramic materials exhibit both electronic and ionic conductivities (of particular interest is oxygen-ion conductivity). These materials transport not only oxygen ions (functioning as selective oxygen separators) but also electrons back from the reactor side to the oxygen-reduction interface. As such, no external electrodes are required and if the driving potential of transport is sufficient, the partial oxidation reactions should be spontaneous. Such a system will operate without an externally applied potential. Oxygen is transported across the ceramic material in the form of oxygen anions and not oxygen molecules. Recent reports in the literature suggest that ceramic membranes made of these mixed conductors can successfully separate oxygen and nitrogen at flux rates that could be considered commercially feasible [1–8]. Long tubes of La-Sr-Fe-Co-O (SFC) membrane have been fabricated by plastic extrusion. Thermodynamic stability of the tubes was studied as a function of oxygen partial pressure by high-temperature XRD. Mechanical properties were measured and found to be adequate for a reactor material. Performance of the membrane strongly depended on the stoichiometry of the material. Fracture of certain SFC tubes was the consequence of an oxygen gradient that introduced a volumetric lattice difference between the inner and outer walls. However, tubes made with a particular stoichiometry (SFC-2) provided methane-conversion efficiencies of >99% in a reactor. Some of these reactor tubes have operated for up to ≈500 h.

27201 (DOE/MC/10637–3742) **Control of gasifier operations using neural networks, Task 7.11: Topical report, September 1992–December 1993.** Cisney, S.; Erjavec, J.; Rao, C.N. North Dakota Univ., Grand Forks, ND (United States). Energy and Environmental Research Center. Apr 1994. 64p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FC21-86MC10637. Order Number DE94004116. Source: OSTI; NTIS; GPO Dep.

The incentive for this project was to investigate applicability of a new modeling tool – a system of equations which emulate the human brain, called neural nets – for chemical process modeling and control at the Dakota Gasification Company (DGC) coal gasification plant in Beulah, North Dakota. The specific goals were (1) to determine guidelines for identifying likely candidate processes for the use of neural nets, (2) to screen the various process areas of the Beulah plant, using these guidelines, (3) select a process area to study, and (4) apply neural nets to model that particular process area. The gasification area was the prominent candidate for the application of neural nets. Calculations showed that it was possible to save over $500,000 by increasing the steam-to-oxygen (S:O) ratio. The problem is that when the S:O ratio is increased, more gas liquor is produced, and there is a limit to how much gas liquor can

be handled downstream. Thus, if a model were available to predict how much gas liquor would be produced, the S:O ratio could be increased to the operating limits. The performance of the neural net was apparently hindered by the type of data input used. Once the known effects of oxygen flow rate and S:O ratio were taken into account, there was no correlation left between any of the input data and the gas liquor flow rate. This result was verified using regression analysis, so there is likely no problem with the neutral net itself. Rather, the conclusion is that the data used did not give any information useful for predicting gas liquor flow. Therefore, in order to apply neural nets to go after the savings, more variables must be logged on a regular basis. The most important variable needed to continue this project is probably the volatiles content of the coal.

27202 (DOE/MC/25038–3818) **Sampling and analyses report for postburn sampling at the RM1 UCG Site, Hanna, Wyoming.** Crader, S.E. Western Research Inst., Laramie, WY (United States). Dec 1988. 60p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG21-88MC25038. Order Number DE94015301. Source: OSTI; NTIS; GPO Dep.

Between November 28, 1988 and December 05, 1988, Western Research Institute (WRI) completed the fourth quarterly Rocky Mountain 1 (RMI) groundwater monitoring for the year 1988. This quarterly sample outing represents the first sampling since the completion of the RM1 groundwater restoration. Background material and the sampling and analytical procedures associated with this task are described in the "Rocky Mountain 1 Postburn Groundwater Monitoring Quality Assurance Plan," prepared by Western Research Institute for the Gas Research Institute and the US Department of Energy. The results of sample analyses for compliance suite parameters of all wells sampled during December, 1988 are presented in Table 3. In general, wells in the west and southwest areas oi the RMI site, the wells that showed the most significant effect during the UCG burn (TW-2, EMW-lla, TW-18, and TW-17), are still showing effects of the burn after the groundwater restoration. There is a trend of higher concentrations of TOC and sulfate, with its associated higher amounts of total dissolved solids, in the groundwater from coal seam wells. Further, cross contamination to groundwater in the overburden units is indicated by the data.

27203 (DOE/MC/26042–3806) **PFBC HGCU test facility technical progress report: First Quarter, CY 1994.** American Electric Power Service Corp., Columbus, OH (United States). Apr 1994. 228p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FC21-89MC26042. Order Number DE94016724. Source: OSTI; NTIS; GPO Dep.

This is the eighteenth Technical Progress Report submitted in connection with the cooperative agreement between the DOE and Ohio Power Company for the Tidd PFBC Hot Gas Clean Up Test Facility. During this quarter, the Tidd Hot Gas Clean Up System operated for 835 hours during six separate test runs. The system was starting into a seventh run at the end of the quarter. Highlights of this period are summarized below: the longest run during the quarter was approximately 333 hours; filter pressure drop was stable during all test runs this quarter using spoiling air to the primary cyclone upstream of the Advanced Particle Filter (APF); the tempering air system was commissioned this quarter which enabled the unit to operate at full load conditions while limiting the gas temperature in the APF to 1,400 F; during a portion of the one run, the tempering air was removed and the filter operated without problems up to 1,450 F; ash sampling was performed by Battelle personnel upstream and downstream of the APF and ash loading and particle size distribution data were obtained, a summary report is included; a hot area on the APF head was successfully repaired in service; a hot spot on the top of an expansion joint was successfully repaired by drilling holes from the inside of the pipe and pumping in refractory insulation; a corrosion inspection program for the HGCU system was issued giving recommendations for points to inspect; filter internal inspections following test runs 13 and 17 revealed a light coating (up to 1/4 inch thick) of residual ash on the candles and some ash bridging between the dust sheds and inner rows of candles. Data from these inspections are included with this report.

27204 (DOE/MC/29246–3773) **Hot coal gas desulfurization with manganese-based sorbents: Annual report, September 1992–September 1993.** Hepworth, M.T. Minnesota Univ., Minneapolis, MN (United States). Dec 1993. 108p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC21-92MC29246. Order Number DE94004138. Source: OSTI; NTIS; GPO Dep.

The focus of work being performed on Hot Coal Gas Desulfurization at the Morgantown Energy Technology Center is primarily in the use of zinc ferrite and zinc titanate sorbents; however, prior studies at the US Steel Fundamental Research Laboratories in Monroeville, PA, by E. T. Turkdogan indicated that an alternate sorbent, manganese dioxide-containing ore in mixture with alumina (75 wt % ore + 25 wt % Al_2O_3) may be a viable alternative to zinc-based sorbents. Manganese, for example, has a lower vapor pressure in the elemental state than zinc hence it is not as likely to undergo depletion from the sorbent surface upon loading and regeneration cycles. Also manganese oxide is less readily reduced to the elemental state than iron hence the range of reduction potentials for oxygen is somewhat greater than for zinc ferrite. In addition, thermodynamic analysis of the manganese-oxygen-sulfur system shows it to be less amenable to sulfation than zinc ferrite. Potential also exists for utilization of manganese at higher temperatures than zinc ferrite or zinc titanate. This Annual Topical Report documents progress in pelletizing and testing via thermogravimetric analysis of individual pellet formulations of manganese ore/alumina combinations and also manganese carbonate/alumina with two binders, dextrin and bentonite. It includes the prior Quarterly Technical Reports which indicate that the manganese carbonate material, being of higher purity than the manganese ore, has a higher degree of sulfur capacity and more rapid absorption kinetics. A 2-inch fixed-bed reactor has been fabricated and is now ready for subjecting pellets to cyclic loading and regeneration.

27205 (DOE/MC/29246–3839) **Hot Coal Gas Desulfurization with manganese-based sorbents: Quarterly report, April–June 1994.** Hepworth, M.T.; Slimane, R.B. Minnesota Univ., Minneapolis, MN (United States). Jun 1994. 10p. Sponsored by USDOE, Washington, DC (United States);Department of the Interior, Washington, DC (United States). DOE Contract AC21-92MC29246. Grant USDI-BM/C0299002-Mod.3. Order Number DE94012271. Source: OSTI; NTIS; GPO Dep.

The focus of work being performed on Hot Coal Gas Desulfurization at the Morgantown Energy Technology Center is primarily in the use of zinc titanate sorbents; however, prior studies indicated that an alternate sorbent, manganese dioxide-containing ore in mixture with alumina (75 wt% ore + 25 wt% Al_2O_3) appears to be a strong contender to zincbased sorbents. Manganese, for example, has a lower vapor pressure in the elemental state than zinc; hence, it is not as likely to undergo zinc-depletion from the sorbent surface upon loading and regeneration cycles. Also manganese oxide is less readily reduced to the elemental state than iron; hence, the range of reduction potentials for oxygen is somewhat greater than for zinc ferrite. In addition, thermodynamic analysis of the manganese-oxygen-sulfur system shows it to be less amenable to sulfation than zinc ferrite. Also manganese chlorides are much less stable and volatile than zinc chlorides. Potential also exists for utilization of manganese at higher temperatures than zinc ferrite or zinc titanate. This Seventh Quarterly Report documents progress in bench-scale testing of a leading manganese-based sorbent pellets (FORM4-A). This formulation is a high-purity manganese carbonate-based material. This formulation was subjected to 20 consecutive cycles of sulfidation and regeneration at 900°C in a 2-inch fixed bed reactor. The sulfidation gas was a simulated Tampella U-gas with an increased hydrogen sulfide content of 3% by volume to accelerate the rate of breakthrough, arbitrarily taken as 500 ppmv. Consistent with thermo-gravimetric analysis (TGA) on individual pellets, the fixed bed tests show small improvement in capacity and kinetics with the sulfur-loading capacity being about 22% by weight of the original pellet, which corresponds to approximately 90% bed utilization!

27206 (DOE/PC/79926–T2) **Kinetics of coal conversion to soluble products: Final technical report.** Larsen, J.W. Lehigh Univ., Bethlehem, PA (United States). Dept. of Chemistry. 12 Apr 1994. 51p. Sponsored by USDOE, Washington, DC (United

States). DOE Contract FG22-87PC79926. Order Number DE94009903. Source: OSTI; NTIS; GPO Dep.

The objectives of this work are (1) to measure the kinetics of the conversion of coals to soluble products under model liquefaction conditions using GPS techniques to count the number of bonds broken; (2) to analyze these data using kinetic schemes based on the behavior of crosslinked macromolecular networks. The product was Soxhlet extracted with pyridine until the pyridine solution was clear. A gel permeation chromatogram of the pyridine soluble is shown in Figure 2A. The improved mass sensitive detector system requires only about 500 ng to acquire a chromatogram having fairly good S/N ratio. Apparently, no disturbance is caused by the remaining tetralin and naphthalene formed by dehydrogenation of tetralin. These seriously affect the lower molecular weight region when IR or UV detectors are used. It is a notable advantage of the mass sensitive detector that suitable adjustment of the nebulizer and of the evaporator completely suppressed the contribution of solvent to the chromatogram. The molecular weight distribution of liquefaction product appears to be almost unimodal if the small shoulder at the lower elution volume side is neglected.

27207 (DOE/PC/90055–T14) **Technology development for iron Fischer-Tropsch catalysts: Technical progress report number 13, 26 September 1993–26 December 1993.** Frame, R.R.; Gala, H.B. UOP, Inc., Des Plaines, IL (United States). [1994]. 13p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC22-90PC90055. Order Number DE94015608. Source: OSTI; NTIS; GPO Dep.

The objectives of this contract are to develop a technology for the production of active and stable iron (Fe) Fischer-Tropsch catalysts for use in slurry-phase synthesis reactors and to develop a scale up procedure for large-scale synthesis of such catalysts for process development and long-term testing in slurry bubble-column reactors. With a feed containing hydrogen (H_2) and carbon monoxide (CO) in the molar ratio of 0.5 to 1.0 to the slurry bubble-column reactor, the catalyst performance target is 88% $CO+H_2$ conversion at a minimum space velocity of 2.4 NL/hr/g Fe. The desired sum of methane and ethane selectivities is no more than 4%, and the conversion loss per week is not to exceed 1%. Results are presented from experimental work performed during this report period.

27208 (DOE/PC/90293–T13) **High temperature membranes for H_2S and SO_2 separations: Quarterly progress report, January 1, 1994–March 31, 1994.** Winnick, J. Georgia Inst. of Tech., Atlanta, GA (United States). School of Chemical Engineering. [1994]. 29p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG22-90PC90293. Order Number DE94017125. Source: OSTI; NTIS; GPO Dep.

High temperature membrane separation techniques have been applied to gas mixtures involved in coal utilization. For coal gasification, H_2S has been removed from the syn-gas stream, split into hydrogen which enriches the syn-gas, and sulfur which can be condensed from an inert gas sweep stream. For coal combustion, SO_2 has been separated from the flue gas, with concentrated SO_3 produced as a by-product. Both processes appear economically viable but each requires fundamental improvements: both the H_2S and SO_2 cells require more efficient membranes and the H_2S cell needs a more efficient anode. Membranes will be fabricated by either hot-pressing, impregnation of sintered bodies, or tape casting. Research conducted during the present quarter is highlighted, with an emphasis on progress toward these goals.

27209 Grate assembly for fixed-bed coal gasifier. Notestein, J.E. To Dept. of Energy. 1992. Filed date 14 Jun 1992. U.S. Patent Application 7-913,095. 26p. Sponsored by USDOE, Washington, DC (United States). Order Number DE94016135. Source: OSTI; NTIS; GPO Dep.

A grate assembly for a coal gasifier of a moving-bed or fixed-bed type is provided for crushing agglomerates of solid material such as clinkers, tailoring the radial distribution of reactant gases entering the gasification reaction zone, and control of the radial distribution of downwardly moving solid velocities in the gasification and combustion zone. The clinker crushing is provided by pinching clinkers between vertically oriented stationary bars and angled bars supported on the upper surface of a rotating conical grate. The distribution of the reactant gases is provided by the selective positioning of horizontally oriented passageways extending through the grate. The radial distribution of the solids is provided by mounting a vertically and generally radially extending scoop mechanism on the upper surface of the grate near the apex thereof.

0106 Properties and Composition

Refer also to citation(s) 27194, 27195, 27222, 27223, 27224, 27225, 27226, 27227, 27228, 27229, 27230, 27231, 27232, 27233

27210 (DOE/PC/92527–T6) **Hindered diffusion of coal liquids: Quarterly report No. 6, December 18, 1993–March 17, 1994.** Tsotsis, T.T. (Univ. of Southern California, Los Angeles (United States)); Sahimi, M.; Webster, I.A. University of Southern California, Los Angeles, CA (United States). Dept. of Chemical Engineering; Unocal Corp., Los Angeles, CA (United States). [1994]. 26p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG22-92PC92527. Order Number DE94016002. Source: OSTI; NTIS; GPO Dep.

Throughout the experimental runs described herein, the authors utilized a high pressure, high temperature diffusion cell system. This diffusion system has been tested through the measurement of the diffusivity of a number of model coal liquids. The project is of both empirical and theoretical nature and is divided into a number of tasks which are reviewed here.

0108 Waste Management

Refer also to citation(s) 27207, 27219, 27631, 27836

27211 (DOE/PC/90544–T14) **Healy Clean Coal Project, Healy, Alaska final Environmental Monitoring Plan.** Alaska Industrial Development and Export Authority, Anchorage, AK (United States); Stone and Webster Engineering Corp., Englewood, CO (United States). 14 Jun 1994. 64p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FC22-91PC90544. Order Number DE94016052. Source: OSTI; NTIS; GPO Dep.

This Environmental Monitoring Plan (EMP) provides the mechanism to evaluate the integrated coal combustion/emission control system being demonstrated by the Healy Clean Coal Project (HCCP) as part-of the third solicitation of the US Department of Energy (DOE) Clean Coal Technology Demonstration Program (CCT-III). The EMP monitoring is intended to satisfy two objectives: (1) to develop the information base necessary for identification, assessment, and mitigation of potential environmental problems arising from replication of the technology and (2) to identify and quantify project-specific and site-specific environmental impacts predicted in the National Environmental Policy Act (NEPA) documents (Environmental Impact Statement and Record of Decision). The EMP contains a description of the background and history of development of the project technologies and defines the processes that will take place in the combustion and spray dryer absorber systems, including the formation of flash-calcined material (FCM) and its use in sulfur dioxide (SO_2) removal from the flue gases. It also contains a description of the existing environmental resources of the project area. The EMP includes two types of environmental monitoring that are to be used to demonstrate the technologies of the HCCP: compliance monitoring and supplemental monitoring. Compliance monitoring activities include air emissions, wastewater effluents, and visibility. Monitoring of these resources provide the data necessary to demonstrate that the power plant can operate under the required state and federal statutes, regulations, and permit requirements.

27212 (DOE/PC/93214–T3) **Separation of flue-gas scrubber sludge into marketable products: Third quarterly technical progress report, March 1, 1994–May 31, 1994.** Kawatra, S.K.; Eisele, T.C.; Shoop, K. Michigan Technological Univ., Houghton, MI (United States). Dept. of Metallurgical and Materials Engineering. Jun 1994. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG22-93PC93214. Order Number DE94016033. Source: OSTI; NTIS; GPO Dep.

Column flotation represents a significant improvement over conventional flotation for many applications. This improvement consists

of increased selectivity between hydrophobic and hydrophilic particles, which allows the column to produce higher-purity products. A schematic of the column used is given in Figure 1. The basic procedure for the flotation column experiments was as follows: 500 grams of the sludge from Plant A (prepared as described in the Second Quarterly Report) was suspended at 40% solids in distilled water, to produce 1600 ml of slurry. Reagents were added, and the slurry was agitated vigorously for 1 minute. Frother was added to all of the water to be added to the column, at a rate of 0.03 grams/liter (approximately 0.4 kilograms per metric ton, Kg/mt). The frother used was Dowfroth 200 (a mixture of polypropylene glycol methyl ethers, with a mean molecular weight of 200). The column was started, all of the water flowrates were set as desired, and the drain valve was closed. As soon as the water level had reached the base of the feed inlet tube (approximately 1 minute after closing the drain valve), the 1600 ml feed slurry was added over a 15 second interval. This allowed the feed to be added to the column with a minimum of disturbance to the froth layer, and without causing either surging of the pulp level or large losses to the sinks product. Flotation was carried out for 9 minutes after closing the drain valve. Froth and sinks products were collected, filtered, dried at 45°C, weighed, and analyzed by thermogravimetic analysis. It is readily seen that, when no collector is added, the column produces a product that is markedly higher purity than that produced by conventional flotation. The addition of oleic acid collector to the column feed is not able to produce any further improvement in product quality, and only results in a loss of product recovery.

27213 (DOE/RL–94-25) **State Waste Discharge Permit application: 200-E Powerhouse Ash Pit.** Atencio, B.P. USDOE Richland Operations Office, WA (United States). Jun 1994. 129p. Sponsored by USDOE, Washington, DC (United States). Order Number DE94015379. Source: OSTI; NTIS; GPO Dep.

As part of the Hanford Federal Facility Agreement and Consent Order negotiations, the US Department and Energy, Richland Operations Office, the US Environmental Protection Agency, and the Washington State Department of Ecology agreed that liquid effluent discharges to the ground on the Hanford Site which affect groundwater or have the potential to affect groundwater would be subject to permitting under the structure of Chapter 173-216 (or 173-218 where applicable) of the Washington Administrative Code, the State Waste Discharge Permit Program. This document constitutes the State Waste Discharge Permit application for the 200-E Powerhouse Ash Pit. The 200-E Powerhouse Ash Waste Water discharges to the 200-E Powerhouse Ash Pit via dedicated pipelines. The 200-E Ash Waste Water is the only discharge to the 200-E Powerhouse Ash Pit. The 200-E Powerhouse is a steam generation facility consisting of a coal-handling and preparation section and boilers.

27214 (DOE/RL–94-26) **State Waste Discharge Permit application: 200-W Powerhouse Ash Pit.** Atencio, B.P. USDOE Richland Operations Office, WA (United States). Jun 1994. 130p. Sponsored by USDOE, Washington, DC (United States). Order Number DE94015378. Source: OSTI; NTIS; GPO Dep.

As part of the Hanford Federal Facility Agreement and Consent Order negotiations; the US Department of Energy, Richland Operations Office, the US Environmental Protection Agency, and the Washington State Department of Ecology agreed that liquid effluent discharges to the ground on the Hanford Site which affect groundwater or have the potential to affect groundwater would be subject to permitting under the structure of Chapter 173-216 (or 173-218 where applicable) of the Washington Administrative Code, the State Waste Discharge Permit Program. This document constitutes the State Waste Discharge Permit application for the 200-W Powerhouse Ash Pit. The 200-W Powerhouse Ash Waste Water discharges to the 200-W Powerhouse Ash Pit via dedicated pipelines. The 200-W Powerhouse Ash Waste Water is the only discharge to the 200-W Powerhouse Ash Pit. The 200-W Powerhouse is a steam generation facility consisting of a coal-handling and preparation section and boilers.

0109 Environmental Aspects

Refer also to citation(s) 27201, 27210

27215 (DOE/MC/25038–3652) **Rocky Mountain 1 underground coal gasification test, Hanna, Wyoming, groundwater evaluation: Final report, June 10, 1988–June 30, 1993.** Lindblom, S.R.; Smith, V.E. Western Research Inst., Laramie, WY (United States). Jun 1993. 485p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG21-88MC25038. Order Number DE94000006. Source: OSTI; NTIS; GPO Dep.

The objectives of this work were to describe the baseline hydrology of the Rocky Mountain 1 (RM1) underground coal gasification (UCG) site, to assess the environmental impacts of the UCG test, and to evaluate the effectiveness of postburn measures taken to minimize aquifer contamination through long-term ground water monitoring. It was found that the RM1 test had significant ephemeral impacts on the hydrology of the primary aquifer at the site, the Hanna No. 1 coal seam. No remaining effect of the RM1 test on ground water elevations is apparent. Finally, the UCG test did affect ground water quality at the site on a short-term basis.

27216 (DOE/MC/25038–3817) **Sampling and analyses report for postburn sampling at the RM1 UCG Site, Hanna, Wyoming.** Crader, S.E. Western Research Inst., Laramie, WY (United States). Dec 1989. 109p. Sponsored by USDOE, Washington, DC (United States);Gas Research Inst., Chicago, IL (United States). DOE Contract FG21-88MC25038 ; FC21-86MC11076. Contract 5087-253-1619. Order Number DE94015300. Source: OSTI; NTIS; GPO Dep.

Western Research Institute (WRI) completed the fourth quarterly groundwater monitoring at the Rocky Mountain 1 (RM1) site for calendar year 1989 between December 2, 1989 and December 7, 1989. This quarterly sampling represents the eighth sample outing since completion of gasification operations. This outing was completed approximately 3 1/2 months after the second groundwater restoration at the RM1 site. Background material and the sampling and analytical procedures associated with the sampling task are described in the "Rocky Mountain 1 Postburn Groundwater Monitoring Quality Assurance Plan," prepared by WRI for the Gas Research Institute and the US DOE.

27217 (DOE/MC/25038–3821) **Sampling and analyses report for postburn sampling at the RM-1 UCG Site, Hanna, WY.** Crader, S.E. Western Research Inst., Laramie, WY (United States). Mar 1989. 60p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG21-88MC25038. Order Number DE94016721. Source: OSTI; NTIS; GPO Dep.

Between March 3, 1989 and March 9, 1989, Western Research Institute (WRI) completed the first quarterly Rocky Mountain 1 (RM1) groundwater monitoring for the year 1989. This quarterly sample outing represents the second sampling since the completion of the RM1 groundwater restoration in September, 1988. Background material and the sampling and analytical procedures associated with the sampling task are described in the "Rocky Mountain 1 Postburn Groundwater Monitoring Quality Assurance Plan," prepared by Western Research Institute for the Gas Research Institute and the U.S. Department of Energy.

27218 (INIS-mf–15007) **The scope of the mine surveyor's statements on soil shifting and reservoir conditions as a basis for mine planning with particular consideration to the requirements of landscape and nature conservation.** Salewski, E.M. Technische Univ. Clausthal, Clausthal-Zellerfeld (Germany). Fakultaet fuer Bergbau, Huettenwesen und Maschinenwesen. 21 Jun 1991. 276p. (In German). Order Number DE94790656. Source: OSTI; NTIS (US Sales Only); INIS.

The scope of the mine surveyor's statements on soil shifting and reservoir conditions as a basis for mine planning with particular consideration to the requirements of landscape and nature conservation. Doctoral dissertation submitted to the Department of Mining, Metallurgy and Engineering at Clausthal University of Technology. The main part of the dissertation discusses the possibilities of an E/A procedure for mining projects. It is possible to interpret the Federal Mining Law in compliance with the law of property as applicable to mining law and environmental requirements. Such an interpretation has been realized in the E/A which aims at formulating goals of environmental quality. It works from a stock-taking of the possible effects of mining on the land surface. Certain requirements, i.e. quality goals are derived from the conditions and

sensitive points peculiar to this environment and used as a measure for assessing and coping with the effects of underground mining and their compensation or palliation and avoidance. The aims of environmental quality formulated in the E/A place general demands on the framework operating plan. The fulfilment of these demands is enforced in the individual case by the subsequent principal and special operating plans referring to specific mining operations. In principle, the operator has free choice of the means and methods of carrying out these plans in underground operations. (orig.)

0130 Transport, Handling, and Storage

Refer also to citation(s) 27193

0140 Combustion

Refer also to citation(s) 27193, 27578, 27630, 27632

27219 (CONF-9404166–) **Conference on alternatives for pollution control from coal-fired low emission sources, Plzen, Czech Republic: Plzen Proceedings.** USDOE, Washington, DC (United States). [1994]. 373p. Sponsored by USDOE, Washington, DC (United States). From Conference on alternatives for pollution control from coal-fired low emission sources; Plzen (Czech Republic); 26-28 Apr 1994. Order Number DE94015592. Source: OSTI; NTIS; GPO Dep.

The Conference on Alternatives for Pollution Control from Coal-Fired Emission Sources presented cost-effective approaches for pollution control of low emission sources (LES). It also identified policies and strategies for implementation of pollution control measures at the local level. Plzen, Czech Republic, was chosen as the conference site to show participants first hand the LES problems facing Eastern Europe today. Collectively, these Proceedings contain clear reports on: (a) methods for evaluating the cost effectiveness of alternative approaches to control pollution from small coal-fired boilers and furnaces; (b) cost-effective technologies for controlling pollution from coal-fired boilers and furnaces; (c) case studies of assessment of cost effective pollution control measures for selected cities in eastern Europe; and (d) approaches for actually implementing pollution control measures in cities in Eastern Europe. It is intended that the eastern/central European reader will find in these Proceedings useful measures that can be applied to control emissions and clean the air in his city or region. The conference was sponsored by the United States Agency for International Development (AID), the United States Department of Energy (DOE), and the Czech Ministry of Industry and Trade. Selected papers have been indexed separately for inclusion in the Energy Science and Technology Database.

27220 (DOE/MC/21023–94/C0346) **Topping combustor development for second-generation pressurized fluidized bed combined cycles.** Domeracki, W.F. (Westinghouse Electric Corp., Orlando, FL (United States). Power Generation Business Unit); Dowdy, T.E.; Bachovchin, D.M. Foster Wheeler Development Corp., Livingston, NJ (United States). [1994]. 12p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC21-86MC21023. (CONF-940626–2: 39. international gas turbine and aeroengine congress and exposition: maintain the edge, The Hague (Netherlands), 13-16 Jun 1994). Order Number DE94015714. Source: OSTI; NTIS; GPO Dep.

A project team consisting of Foster Wheeler Development Corp. Westinghouse Electric Corp., Gilbert/Commonwealth and the Institute of Gas Technology, are developing a Second Generation Pressurized Fluidized Bed System. Foster Wheeler is developing a carbonizer (a partial gasifier) and a pressurized fluidized bed combustor. Both these units operate a nominal 1600°F (870°C) for optimal sulfur capture. Since this temperature is well below the current combustion turbine combustor outlet operating temperature of 2350°F (1290°C) to reach commercialization, a topping combustor and hot gas cleanup (HGCU) equipment must be developed. Westinghouse is participating in the development of the high temperature gas cleanup equipment and the topping combustor. This paper concentrates on the design and test of the topping combustor. The topping combustor in this cycle must utilize a low heating value syngas from the carbonizer at approximately 1600°F (870°C) and 150 to 210 psi (1.0 to 1.4 MPa). The syngas entering the topping combustor has been previously cleaned of particulates and alkali by the hot gas cleanup (HGCU) system. It also contains significant fuel bound nitrogen present as ammonia and other compounds. The fuel-bound nitrogen is significant because it will selectively convert to NO_x if the fuel is burned under the highly oxidizing conditions of standard combustion turbine combustors.

27221 (DOE/MC/24207–3322) **An experimental study of the hydrodynamics and cluster formation in a circulating fluidized bed: Topical report, January 1, 1991–June 30, 1992.** Gautam, M.; Jurewicz, J.; Heping, Y.; Clifton, K. West Virginia Univ., Morgantown, WV (United States). Dept. of Mechanical and Aerospace Engineering. Jul 1992. 147p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FC21-87MC24207. Order Number DE94004090. Source: OSTI; NTIS; GPO Dep.

This research program involves two major aspects. First, to evaluate techniques to effectively probe the polydisperse gas-solid flows and second, to apply these techniques to study the gas-solid flow structure and clusters in the riser of a circulating fluidized bed riser. Amongst the non-intrusive techniques a modified laser Doppler technique based on the fluorescence-emission concept has been adopted and the other techniques involve pitot-static pressure probes. A circulating fluidized bed (CFB) facility has been designed, built and is currently operational at West Virginia University. The design provides for maximum versatility in investigating the hydrodynamics of the CFB riser. Two stage cyclones are employed to capture the particles exhausted from the riser. Measurements of gas velocity distribution were carried out in the circulating fluidized bed riser. with particles having a mean diameter of 112 μm and a density of 2305 kg/m^3 and another set of particles with a mean diameter of 145 μm and a density of 2245 kg/m^3. The experimental results showed that the local gas velocity varied with the radial position, elevation, solids circulation rate, superficial velocity and particle size. A general formula for gas velocity distribution in the circulating fluidized bed riser was obtained based on the particle circulation, superficial velocity and particle diameter. The pressure drops across the L-valve were also studied for different particle sizes, L-valve diameters and aeration. The solids flowrate was found to be a function of the L-valve geometry, operating parameters and solids properties. Pressure drop of L-valve increases with increasing solids diameter and decreasing diameter of the L-valve. Pressure drop across standpipe increases as the solids diameter and diameter of the standpipe decrease.

27222 (DOE/MC/24207–3473) **An experimental study of the hydrodynamics and cluster formation in a circulating fluidized-bed riser: Semi-annual report, July 1, 1992–December 31, 1992.** Gautam, M.; Jurewicz, J.T.; Johnson, E.K.; Heping, Y. West Virginia Univ., Morgantown, WV (United States). Dept. of Mechanical and Aerospace Engineering. Jan 1993. 60p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FC21-87MC24207. Order Number DE94000013. Source: OSTI; NTIS; GPO Dep.

A novel gas-solid flow measuring technique is being developed and tested for studying the hydrodynamics inside the riser of a Circulating Fluidized Bed (CFB). First of the two aims of the overall program, namely, design, development and testing of the technique to characterize the particle and gas velocities in two-phase flows was accomplished in the past year. The second objective, that of making detailed measurements of gas and solid phases in the rises of a cold CFB model to investigate the phenomena of clusters and streamers for different bed operating parameters is being accomplished in the current year. The differential pressure fluctuations were in order to study the solids cluster formation. Of the several factors which lead to differential pressure fluctuations, the solids cluster formation in CFB riser is by far the most important of all. Simultaneously, theoretical formulation of the two-phase flow in the CFB riser was initiated. The concept of entropy maximization is being applied to explain the hydrodynamics inside the riser. The results from this study will present a unique detailed description of the complex gas-solid behavior in the CFB riser.

27223 (DOE/PC/88654–T8) **Combustion characterization of beneficiated coal-based fuels: Quarterly report No. 8,**

January–March 1991. Chow, O.K.; Nsakala, N.Y. Combustion Engineering, Inc., Windsor, CT (United States). Jul 1991. 70p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC22-89PC88654. Order Number DE94016019. Source: OSTI; NTIS; GPO Dep.

The Pittsburgh Energy Technology Center of the US Department of Energy has contracted with Combustion Engineering, Inc. (CE) to perform a five-year project on "Combustion Characterization of Beneficiated Coal-Based Fuels." The beneficiated coals are produced by other contractors under the DOE Coal Preparation Program. Several contractor-developed advanced coal cleaning processes are run at pilot-scale cleaning facilities to produce 20-ton batches of fuels for shipment to CE's laboratory in Windsor, Connecticut. CE then processes the products into either a coal-water fuel (CWF) or a dry microfine pulverized coa1 (DMPC) form for combustion testing. The objectives of this project include: (1) the development of an engineering data base which will provide detailed information on the properties of BCFs influencing combustion, ash deposition, ash erosion, particulate collection, and emissions; and (2) the application of this technical data base to predict the performance and economic impacts of firing the BCFs in various commercial boiler designs. During the third quarter of 1991, the following technical progress was made: Calculated the kinetic characteristics of chars from the combustion of spherical oil agglomeration beneficiated products; continued drop tube devolatilization tests of the spherical oil agglomeration beneficiated products; continued analyses of the data and samples from the CE pilot-scale tests of nine fuels; and started writing a summary topical report to include all results on the nine fuels tested.

27224 (DOE/PC/88654–T9) **Combustion characterization of beneficiated coal-based fuels: Quarterly report No. 9, April–June 1991.** Chow, O.K.; Nsakala, N.Y. Combustion Engineering, Inc., Windsor, CT (United States). Aug 1991. 19p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC22-89PC88654. Order Number DE94016020. Source: OSTI; NTIS; GPO Dep.

The Pittsburgh Energy Technology Center of the US Department of Energy has contracted with Combustion Engineering, Inc. (CE) to perform a five-year project on "Combustion Characterization of Beneficiated Coal-Based Fuels." The beneficiated coals are produced by other contractors under the DOE Coal Preparation Program. Several contractor-developed advanced coal cleaning processes are run at pilot-scale cleaning facilities to produce 20-ton batches of fuels for shipment to CE's laboratory in Windsor, Connecticut. CE then processes the products into either a coal-water fuel (CWF) or a dry microfine pulverized coa1 (DMPC) form for combustion testing. The objectives of this project include: (1) the development of an engineering data base which will provide detailed information on the properties of BCFs influencing combustion, ash deposition, ash erosion, particulate collection, and emissions; and (2) the application of this technical data base to predict the performance and economic impacts of firing the BCFs in various commercial boiler designs. During the second quarter of 1991, the following technical progress was made: completed drop tube furnace devolatilization tests of the spherical oil agglomeration beneficiated products; continued analyses of samples to determine devolatilization kinetics; continued analyses of the data and samples from the CE pilot-scale tests of nine fuels; completed writing a summary topical report including all results to date on he nine fuels tested; and presented three technical papers on the project results at the 16th International Conference on Coal & Slurry Technologies.

27225 (DOE/PC/88654–T10) **Combustion characterization of beneficiated coal-based fuels: Quarterly report No. 10, July–September 1991.** Chow, O.K.; Nsakala, N.Y. Combustion Engineering, Inc., Windsor, CT (United States). Nov 1991. 46p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC22-89PC88654. Order Number DE94016021. Source: OSTI; NTIS; GPO Dep.

The Pittsburgh Energy Technology Center of the US Department of Energy has contracted with Combustion Engineering, Inc. (CE) to perform a five-year project on "Combustion Characterization of Beneficiated Coal-Based Fuels." The beneficiated coals are produced by other contractors under the DOE Coal Preparation Program. Several contractor-developed advanced coal cleaning processes are run at pilot-scale cleaning facilities to produce 20-ton batches of fuels for shipment to CE's laboratory in Windsor, Connecticut. CE then processes the products into either a coal-water fuel (CWF) or a dry microfine pulverized coa1 (DMPC) form for combustion testing. The objectives of this project include: (1) the development of an engineering data base which will provide detailed information on the properties of BCFs influencing combustion, ash deposition, ash erosion, particulate collection, and emissions; and (2) the application of this technical data base to predict the performance and economic impacts of firing the BCFs in various commercial boiler designs. During the third quarter of 1991, the following technical progress was made: Continued analyses of drop tube furnace samples to determine devolatilization kinetics; completed analyses of the samples from the pilot-scale ash deposition tests of unweathered Upper Freeport fuels; completed editing of the first three quarterly reports and sent them to the publishing office; presented the project results at the Annual Contractors' Conference.

27226 (DOE/PC/88654–T11) **Combustion characterization of beneficiated coal-based fuels: Quarterly report No. 11, October–December 1991.** Chow, O.K.; Nsakala, N.Y. Combustion Engineering, Inc., Windsor, CT (United States). Mar 1992. 45p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC22-89PC88654. Order Number DE94016022. Source: OSTI; NTIS; GPO Dep.

The objectives of this project include: (1) the development of an engineering data base which will provide detailed information on the properties of beneficiated coal-based fuels (BCFs) influencing combustion, ash deposition, ash erosion, particulate collection, and emissions; and (2) the application of this technical data base to predict the performance and economic impacts of firing the BCFs in various commercial boiler designs. The technical approach used to develop the technical data includes: bench-scale fuel property, combustion, and ash deposition tests; pilot-scale combustion and ash effects tests; and full-scale combustion tests. Subcontractors perform parts of the test work are the Massachusetts Institute of Technology Physical Science, Inc. Technology Company and the University of North Dakota Energy and Environmental Research Center. Twenty fuels will be characterized during the three-year base program: three feed coals, fifteen BCFs, and two conventionally cleaned coals for full-scale tests. Approximately nine BCFs will be in dry ultra fine coal (DUC) form, and six BCFs will be in coal-water fuel (CWF) form. Additional BCFs would be characterized during optional project supplements. During the third quarter of 1991, the following technical progress was made: Continued analyses of drop tube furnace samples to determine devolatilization kinetics; completed analyses of the samples from the pilot-scale ash deposition tests of three Freeport Pittsburgh 8 fuels; conducted pilot-scale combustion and ash deposition tests of a fresh batch of Upper Freeport parent coal in the CE fireside Performance Test Facility; and completed editing of the fourth quarterly report and sent it to the publishing office.

27227 (DOE/PC/88654–T12) **Combustion characterization of beneficiated coal-based fuels: Quarterly report No. 12, January–March 1992.** Chow, O.K.; Nsakala, N.Y. Combustion Engineering, Inc., Windsor, CT (United States). Aug 1992. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC22-89PC88654. Order Number DE94016023. Source: OSTI; NTIS; GPO Dep.

The Pittsburgh Energy Technology Center of the US Department of Energy has contracted with Combustion Engineering, Inc. (CE) to perform a five-year project on "Combustion Characterization of Beneficiated Coal-Based Fuels." The beneficiated coals are produced by other contractors under the DOE Coal Preparation Program. Several contractor-developed advanced coal cleaning processes are run at pilot-scale cleaning facilities to produce 20-ton batches of fuels for shipment to CE's laboratory in Windsor, Connecticut. CE then processes the products into either a coal-water fuel (CWF) or a dry microfine pulverized coa1 (DMPC) form for combustion testing. The objectives of this project include: (1)

the development of an engineering data base which will provide detailed information on the properties of BCFs influencing combustion, ash deposition, ash erosion, particulate collection, and emissions; and (2) the application of this technical data base to predict the performance and economic impacts of firing the BCFs in various commercial boiler designs. The technical approach used to develop the technical data includes: bench-scale fuel property, combustion, and ash deposition tests; pilot-scale combustion and ash effects tests; and full-scale combustion tests. During the third quarter of 1992, the following technical progress was made: Continued analyses of drop tube furnace samples to determine devolatilization kinetics; completed editing of the fifth quarterly report and sent it to the publishing office; and prepared two technical papers for conferences.

27228 (DOE/PC/88654–T13) **Combustion characterization of beneficiated coal-based fuels: Quarterly report No. 13, April–June 1992.** Chow, O.K.; Nsakala, N.Y. Combustion Engineering, Inc., Windsor, CT (United States). Sep 1992. 38p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC22-89PC88654. Order Number DE94016024. Source: OSTI; NTIS; GPO Dep.

The Pittsburgh Energy Technology Center of the US Department of Energy has contracted with Combustion Engineering, Inc. (CE) to perform a five-year project on "Combustion Characterization of Beneficiated Coal-Based Fuels." The beneficiated coals are produced by other contractors under the DOE Coal Preparation Program. Several contractor-developed advanced coal cleaning processes are run at pilot-scale cleaning facilities to produce 20-ton batches of fuels for shipment to CE's laboratory in Windsor, Connecticut. CE then processes the products into either a coal-water fuel (CWF) or a dry microfine pulverized coa1 (DMPC) form for combustion testing. The objectives of this project include: (1) the development of an engineering data base which will provide detailed information on the properties of BCFs influencing combustion, ash deposition, ash erosion, particulate collection, and emissions; and (2) the application of this technical data base to predict the performance and economic impacts of firing the BCFs in various commercial boiler designs. The technical approach used to develop the technical data includes: bench-scale fuel property, combustion, and ash deposition tests; pilot-scale combustion and ash effects tests; and full-scale combustion tests. During the third quarter of 1992, the following technical progress was made: Continued analyses of drop tube furnace samples to determine devolatilization kinetics; completed analyses of the samples from the pilot-scale ash deposition tests of unweathered Upper Freeport feed coal; published two technical papers at conferences; and prepared for upcoming tests of new BCFs being produced.

27229 (DOE/PC/88654–T14) **Combustion characterization of beneficiated coal-based fuels: Quarterly report No. 14, July–September 1992.** Chow, O.K.; Nsakala, N.Y. ABB Combustion Engineering, Windsor, CT (United States). Power Plant Labs. Feb 1993. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC22-89PC88654. Order Number DE94016025. Source: OSTI; NTIS; GPO Dep.

The Pittsburgh Energy Technology Center of the US Department of Energy has contracted with Combustion Engineering, Inc. (CE) to perform a five-year project on "Combustion Characterization of Beneficiated Coal-Based Fuels." The beneficiated coals are produced by other contractors under the DOE Coal Preparation Program. Several contractor-developed advanced coal cleaning processes are run at pilot-scale cleaning facilities to produce 20-ton batches of fuels for shipment to CE's laboratory in Windsor, Connecticut. CE then processes the products into either a coal-water fuel (CWF) or a dry microfine pulverized coa1 (DMPC) form for combustion testing. The objectives of this project include: (1) the development of an engineering data base which will provide detailed information on the properties of BCFs influencing combustion, ash deposition, ash erosion, particulate collection, and emissions; and (2) the application of this technical data base to predict the performance and economic impacts of firing the BCFs in various commercial boiler designs. The technical approach used to develop the technical data includes: bench-scale fuel property, combustion, and ash deposition tests; pilot-scale combustion and ash effects tests; and full-scale combustion tests. During the third quarter of 1992, the following technical progress was made: Continued analyses of drop tube furnace samples to determine devolatilization kinetics; published two technical papers at conferences; and prepared for upcoming tests of new BCFs being produced.

27230 (DOE/PC/88654–T15) **Combustion characterization of beneficiated coal-based fuels: Quarterly report No. 15, October–December 1992.** Chow, O.K.; Nsakala, N.Y. ABB Combustion Engineering, Windsor, CT (United States). Power Plant Labs. Mar 1993. 44p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC22-89PC88654. Order Number DE94016026. Source: OSTI; NTIS; GPO Dep.

The Pittsburgh Energy Technology Center of the US Department of Energy has contracted with Combustion Engineering, Inc. (CE) to perform a five-year project on "Combustion Characterization of Beneficiated Coal-Based Fuels." The beneficiated coals are produced by other contractors under the DOE Coal Preparation Program. Several contractor-developed advanced coal cleaning processes are run at pilot-scale cleaning facilities to produce 20-ton batches of fuels for shipment to CE's laboratory in Windsor, Connecticut. CE then processes the products into either a coal-water fuel (CWF) or a dry microfine pulverized coa1 (DMPC) form for combustion testing. The objectives of this project include: (1) the development of an engineering data base which will provide detailed information on the properties of BCFs influencing combustion, ash deposition, ash erosion, particulate collection, and emissions; and (2) the application of this technical data base to predict the performance and economic impacts of firing the BCFs in various commercial boiler designs. The technical approach used to develop the technical data includes: bench-scale fuel property, combustion, and ash deposition tests; pilot-scale combustion and ash effects tests; and full-scale combustion tests. During the third quarter of 1992, the following technical progress was made: Continued analyses of drop tube furnace samples to determine devolatilization kinetics; re-analyzed the samples from the pilot-scale ash deposition tests of the first nine feed coals and BCFs using a modified CCSEM technique; updated the topical summary report; and prepared for upcoming tests of new BCFs being produced.

27231 (DOE/PC/88654–T16) **Combustion characterization of beneficiated coal-based fuels: Quarterly report No. 16, January–March 1993.** Chow, O.K.; Nsakala, N.Y. ABB Combustion Engineering, Windsor, CT (United States). Power Plant Labs. May 1993. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC22-89PC88654. Order Number DE94016027. Source: OSTI; NTIS; GPO Dep.

The Pittsburgh Energy Technology Center of the US Department of Energy has contracted with Combustion Engineering, Inc. (CE) to perform a five-year project on "Combustion Characterization of Beneficiated Coal-Based Fuels." The beneficiated coals are produced by other contractors under the DOE Coal Preparation Program. Several contractor-developed advanced coal cleaning processes are run at pilot-scale cleaning facilities to produce 20-ton batches of fuels for shipment to CE's laboratory in Windsor, Connecticut. CE then processes the products into either a coal-water fuel (CWF) or a dry microfine pulverized coa1 (DMPC) form for combustion testing. The objectives of this project include: (1) the development of an engineering data base which will provide detailed information on the properties of BCFs influencing combustion, ash deposition, ash erosion, particulate collection, and emissions; and (2) the application of this technical data base to predict the performance and economic impacts of firing the BCFs in various commercial boiler designs. The technical approach used to develop the technical data includes: bench-scale fuel property, combustion, and ash deposition tests; pilot-scale combustion and ash effects tests; and full-scale combustion tests. During the first quarter of 1993, the following technical progress was made: Reported results of drop tube furnace data analyses to determine devolatilization kinetics; reported the results from the re-analyzed pilot-scale ash deposits from the first nine feed coals and BCFs using a modified CCSEM technique; and prepared for upcoming tests of new BCFs being produced.

27232 (DOE/PC/88654–T17) **Combustion characterization of beneficiated coal-based fuels: Quarterly report No. 17,**

April–June 1993. Chow, O.K.; Nsakala, N.Y. ABB Combustion Engineering, Windsor, CT (United States). Power Plant Labs. Aug 1993. 62p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC22-89PC88654. Order Number DE94016028. Source: OSTI; NTIS; GPO Dep.

Pittsburgh Energy Technology Center of the US Department of Energy has contracted with Combustion Engineering, Inc. (CE) to perform a five-year project on "Combustion Characterization of Beneficiated Coal-Based Fuels." The beneficiated coals are produced by other contractors under the DOE Coal Preparation Program. Several contractor-developed advanced coal cleaning processes are run at pilot-scale cleaning facilities to produce 20-ton batches of fuels for shipment to CE's laboratory in Windsor, Connecticut. CE then processes the products into either a coal-water fuel (CWF) or a dry microfine pulverized coa1 (DMPC) form for combustion testing. The objectives of this project include: (1) the development of an engineering data base which will provide detailed information on the properties of BCFs influencing combustion, ash deposition, ash erosion, particulate collection, and emissions; and (2) the application of this technical data base to predict the performance and economic impacts of firing the BCFs in various commercial boiler designs. The technical approach used to develop the technical data includes: bench-scale fuel property, combustion, and ash deposition tests; pilot-scale combustion and ash effects tests; and full-scale combustion tests. During the third quarter of 1993, the following technical progress was made: Completed modeling calculations of coal mineral matter transformations, deposition behavior, and heat transfer impacts of six test fuels; and ran pilot-scale tests of Upper Freeport feed coal, microagglomerate product, and mulled product.

27233 (DOE/PC/88654–T18) **Combustion characterization of beneficiated coal-based fuels: Quarterly report No. 18, July–September 1993.** Chow, O.K.; Hargrove, M.J. ABB Combustion Engineering, Windsor, CT (United States). Power Plant Labs. Nov 1993. 23p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC22-89PC88654. Order Number DE94016029. Source: OSTI; NTIS; GPO Dep.

The Pittsburgh Energy Technology Center of the US Department of Energy has contracted with Combustion Engineering, Inc. (CE) to perform a five-year project on "Combustion Characterization of Beneficiated Coal-Based Fuels." The beneficiated coals are produced by other contractors under the DOE Coal Preparation Program. Several contractor-developed advanced coal cleaning processes are run at pilot-scale cleaning facilities to produce 20-ton batches of fuels for shipment to CE's laboratory in Windsor, Connecticut. CE then processes the products into either a coal-water fuel (CWF) or a dry microfine pulverized coal (DMPC) form for combustion testing. The objectives of this project include: (1) the development of an engineering data base which will provide detailed information on the properties of BCFs influencing combustion, ash deposition, ash erosion, particulate collection, and emissions; and (2) the application of this technical data base to predict the performance and economic impacts of firing the BCFs in various commercial boiler designs. The technical approach used to develop the technical data includes: bench-scale fuel property, combustion, and ash deposition tests; pilot-scale combustion and ash effects tests; and full-scale combustion tests. During the third quarter of 1993, the following technical progress was made: Continued with data and sample analysis from the pilot-scale tests of Upper Freeport feed coal, air-dried and mulled microagglomerate products; air-dried Pittsburgh No. 8 as-is and mulled products for upcoming Task 3 combustion testing; and prepared two abstracts for presentation for the March 1 994 Coal Utilization and Fuel Systems Conference.

27234 (DOE/PC/91292–T11) **Rheological properties essential for the atomization of coal water slurries (CWS): Quarterly progress report, March 15–June 15, 1994.** Ohene, F. Grambling State Univ., LA (United States). Dept. of Chemistry. [1994]. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG22-91PC91292. Order Number DE94016030. Source: OSTI; NTIS; GPO Dep.

The overall objective of this project is to perform experiments to understand the effect of high shear and extensional properties on the atomization of coal-water slurries (CWS). In the atomization studies, the mean drop size of the CWS sprays will be determined at various air-to CWS. A correlation between the extensional and high shear properties, particle size distributions and the atomization will be made in order to determine the influence of these parameters on the atomization of CWS. A CV20 attachment to a Haake RV20 viscometer and a PQ45 sensor were received during this past quarter. This was followed by several hours of calibration of the sensors using a non-elastic fluid. Also, a literature review was made in order to further understand dynamic oscillatory shear flow.

27235 (DOE/PC/92539–7) **Volatiles combustion in fluidized beds: [Quarterly] technical progress report, 4 March 1994–3 June 1994.** Pendergrass, R.A. II; Hesketh, R.P. Tulsa Univ., OK (United States). [1994]. 26p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG22-92PC92539. Order Number DE94016017. Source: OSTI; NTIS; GPO Dep.

The goal of this project is to investigate the conditions in which volatiles will burn within both the dense and freeboard regions of fluidized beds. Experiments using a fluidized bed operated at incipient fluidization will be performed to characterize the effect of particle surface area, initial fuel concentration, and particle type on the, inhibition of volatiles within a fluidized bed. The work conducted during the period 4 March, 1994 through 3 June, 1994 is reported in this technical progress report. The experimental work during this time period consists primarily of data collection. Gas composition results using two sand particle diameters of 0.531 and 0.126 mm. Three graphs at equivalence ratios of 0.5, 1.0 and 2.0 for propane in air are reported for the 0.531 mm sand size. For the 0.126 nun sand size stoichiometric propane and air are results are reported.

27236 (SAND–94-8231, pp. 1.1-1.29) **Kinetics and mechanisms of pulverized coal char combustion.** Hurt, R.H. (Sandia National Labs., Livermore, CA (United States)); Davis, K.A.; Hardesty, D.R. Sandia National Labs., Albuquerque, NM (United States). May 1994. In *Coal combustion science: Quarterly progress report, April 1993–June 1993.* 64p. Order Number DE94012412. Source: OSTI; NTIS; GPO Dep.

The objective of Task 1 is to characterize the combustion behavior of selected U.S. coals under conditions relevant to industrial pulverized coal-fired furnaces. In Sandia's Coal Combustion Laboratory (CCL), optical techniques are used to obtain high-resolution images of individual burning coal char particles and to measure, in situ, their temperatures, sizes, and velocities. Detailed models of combustion transport processes are then used to determine kinetic parameters describing the combustion behavior as a function of coal type and combustion environment. Partially reacted char particles are also sampled and characterized with advanced materials diagnostics to understand the critical physical and chemical transformations that influence reaction rates and burnout times. The ultimate goal of the task is the establishment of a data base of the high temperature reactivities of chars from strategic U.S. coals, from which important trends may be identified and predictive capabilities developed. Research is divided into the four subtasks described below, in accordance with the FY92 - FY94 project plan.

27237 (SAND–94-8231, pp. 2.1-2.24) **The fate of inorganic material during coal combustion.** Baxter, L.L. (Sandia National Labs., Livermore, CA (United States)); Hardesty, D.R. Sandia National Labs., Albuquerque, NM (United States). May 1994. In *Coal combustion science: Quarterly progress report, April 1993–June 1993.* 64p. Order Number DE94012412. Source: OSTI; NTIS; GPO Dep.

The overall objectives for FY93 are: (1) to complete experimental and theoretical investigation of ash release mechanisms; (2) to complete experimental work on char fragmentation; (3) to establish the extent of coal (as opposed to char) fragmentation as a function of coal type and particle size; (4) to develop diagnostic capabilities for in situ, real-time, qualitative indications of surface species composition during ash deposition, with work continuing into FY94; (5) to develop diagnostic capabilities for in situ, real-time qualitative detection of inorganic vapor concentrations; and (6) to conduct a literature survey on the current state of understanding of ash deposition, with work continuing into FY94. Three subtasks are discussed below that address these objectives. The features of the work to be performed in FY93 include: (1) completion of mineral

matter release studies dealing with major species; (2) studies of coal fragmentation during devolatilization; (3) collection of preliminary surface species composition data using FTIR or other real time, in situ optical techniques; and (4) documentation of ADLVIC.

27238 (SAND–94-8241) **Coal combustion science: Task 1, Coal char combustion: Task 2, Fate of mineral matter: Quarterly progress report, July–September 1993.** Hardesty, D.R. (ed.); Hurt, R.H.; Davis, K.A.; Baxter, L.L. Sandia National Labs., Livermore, CA (United States). Jul 1994. 112p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DR00789. Order Number DE94015781. Source: OSTI; NTIS; GPO Dep.

Progress reports are presented for the following tasks: (1) kinetics and mechanisms of pulverized coal char combustion and (2) fate of inorganic material during coal combustion. The objective of Task 1 is to characterize the combustion behavior of selected US coals under conditions relevant to industrial pulverized coal-fired furnaces. In Sandia's Coal Combustion Laboratory (CCL), optical techniques are used to obtain high-resolution images of individual burning coal char particles and to measure, in situ, their temperatures, sizes, and velocities. Detailed models of combustion transport processes are then used to determine kinetic parameters describing the combustion behavior as a function of coal type and combustion environment. Partially reacted char particles are also sampled and characterized with advanced materials diagnostics to understand the critical physical and chemical transformations that influence reaction rates and burnout times. The ultimate goal of the task is the establishment of a data base of the high temperature reactivities of chars from strategic US coals, from which important trends may be identified and predictive capabilities developed. The overall objectives for task 2 are: (1) to complete experimental and theoretical investigation of ash release mechanisms; (2) to complete experimental work on char fragmentation; (3) to establish the extent of coal (as opposed to char) fragmentation as a function of coal type and particle size; (4) to develop diagnostic capabilities for in situ, real-time, qualitative indications of surface species composition during ash deposition, with work continuing into FY94; (5) to develop diagnostic capabilities for in situ, real-time qualitative detection of inorganic vapor concentrations; and (6) to conduct a literature survey on the current state of understanding of ash deposition, with work continuing into FY94.

27239 (SAND–94-8652C) **Residual carbon from pulverized coal fired boilers 1: Size distribution and combustion reactivity.** Hurt, R.H. (Sandia National Labs., Livermore, CA (United States)); Gibbins, J.R. Sandia National Labs., Livermore, CA (United States). [1994]. 32p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. (CONF-940397–5: Wester States section of the Combustion Institute spring meeting, Davis, CA (United States), 21-22 Mar 1994). Order Number DE94016614. Source: OSTI; NTIS; GPO Dep.

The amount of residual, or unburned, carbon in fly ash is an important concern in the design and operation of pulverized coal-fired boilers. Char oxidation is the slowest step in the coal combustion process, and the rate at which this heterogeneous reaction-proceeds has an important effect on the degree of carbon burnout. There is an extensive literature on char combustion kinetics based on data in the early and intermediate stages of carbon conversion. A critical fundamental question is whether the small fraction of the fuel carbon that passes unreacted through a boiler is representative of the char during the main portion of the combustion process. This article addresses that question through a detailed characterization of eight carbon-containing fly ash samples acquired from commercial-scale combustion systems. The fly ash characterization included measurement-of joint carbon/size distribution and determination.of the combustion reactivity of the residual carbon. To minimize mineral matter interactions in the reactivity tests, the technique of incipient fluidization was developed for separation of carbon-rich extracts from the inorganic portion of the fly ash. Reactivity measurements were made at 1400–1800 K to represent conditions in pulverized coal fired boilers. Measurements were also made at 700–1100 K to. minimize transport effects and isolate the influence of char chemistry and microstructure. In both temperature regimes, the residual carbon extracts. were significantly less reactive than chars extracted from a laboratory-scale laminar flow reactor in the early-to-intermediate stages of combustion. It is concluded that the boiler environment deactivates chars, making high carbon burnout more difficult to achieve than is predicted by existing char combustion kinetic models that were developed from data on the laboratory chars. Finally, the results are used to discuss potential char deactivation mechanisms, both thermal and oxidative, in coal-fired boilers.

0150 Economic, Industrial, and Business Aspects

27240 (DOE/EIA–0202(94)) **Short-term energy outlook, annual supplement 1994.** USDOE Energy Information Administration, Washington, DC (United States). Office of Energy Markets and End Use. Aug 1994. 70p. Sponsored by USDOE, Washington, DC (United States). Order Number DE94016956. Source: OSTI; NTIS; INIS; GPO; GPO Dep.

The Short-Term Energy Outlook Annual Supplement (Supplement) is published once a year as a complement to the Short-Term Energy Outlook (Outlook), Quarterly Projections. The purpose of the Supplement is to review the accuracy of the forecasts published in the Outlook, make comparisons with other independent energy forecasts, and examine current energy topics that affect the forecasts.

0170 Legislation and Regulations

Refer also to citation(s) 27217

02 PETROLEUM

0202 Reserves, Geology, and Exploration

Refer also to citation(s) 27244

27241 (DOE/BC/14475–T1) **Geophysical and transport properties of reservoir rocks: Summary annual report.** Cook, N.G.W. California Univ., Berkeley, CA (United States). 29 Apr 1990. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC22-89BC14475. Order Number DE94015874. Source: OSTI; NTIS; GPO Dep.

Definition of petrophysical properties, such as porosity, permeability and fluid saturation, on the scale of meters, is the key to planning and control of successful Enhanced Oil Recovery techniques for domestic reservoirs. Macroscopic transport properties in reservoir rocks depend critically upon processes at the pore level involving interactions between the pore topology and the physical and chemical properties of the rock minerals and interstitial fluids. Similar interactions at the pore level determine also the macroscopic electrical and seismic properties of reservoir rocks. The objective of this research is to understand, using analysis and experiment, how fluids in pores affect the geophysical and sport properties of reservoir rocks. The goal is to develop equations-relating seismic and electrical properties of rock to the porosity, permeability and fluid saturations so as to invert geophysical images for improved reservoir management. Results from seismic measurements performed so far in this study suggest that even subtle changes in fluid contacts and the in-situ state of effective stress can be detected using geophysical imaging techniques. The experiments using Wood's metal and wax are revealing the topology and sport properties of the pore space in clastic sedimentary rocks. A deeper understanding of these properties is considered-to be the key to the recovery of much of the mobile oil left in domestic reservoirs and to the effective management of enhanced oil recovery techniques. The results of Wood's metal percolation tests indicate that most of the permeability of Berea sandstone resides in the critical percolating paths and these paths occupy only a small fraction of the total porosity. This result may have important implications for flooding in terms of override and efficiency as a function of saturation.

27242 (DOE/ID/12842–3) **Development of improved methods for locating large areas of bypassed oil in Louisiana: Final report.** Bourgoyne, A.T. Jr.; Kimbrell, C. Louisiana State Univ., Baton Rouge, LA (United States). Jul 1994. 107p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG07-89ID12842. Order Number DE94000136. Source: OSTI; NTIS; GPO Dep.

The primary objective of the project was to develop a predictive method for locating Pockets of bypassed mobile oil and estimating the volume of this resource. A secondary objective of the project was to transfer the learned technology to small independent operators who drill a majority of the domestic wells but lack access to a research staff. Another objective was to develop a format for compiling data on Louisiana reservoirs in a form that can be used by government and industry to evaluate the resource and plan future activities. The format developed will be demonstrated using data compiled in the bypassed oil study for selected reservoirs. The project was being funded over a three-year period and was jointly funded by the DOE and the state of Louisiana. The objectives of the project were accomplished using an interdisciplinary approach which included the disciplines of engineering, geology, and computer science. The work was organized into the following major tasks: Selection of reservoirs for study of bypassed oil potential; development of improved reservoir simulator for bypassed oil prospecting; an interdisciplinary reservoir characterization study of Louisiana reservoirs; active modelling of bypassed oil for three Louisiana reservoirs; and technology transfer activities.

27243 (DOE/NV/10412–9) **Consolidation of geologic studies of geopressured-geothermal resources in Texas: Barrier-bar tidal-channel reservoir facies architecture, Jackson Group, Prado Field, South Texas: Final report.** Seni, S.J.; Choh, S.J. Texas Univ., Austin, TX (United States). Bureau of Economic Geology. Sep 1993. 54p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FC07-85NV10412. Order Number DE94015520. Source: OSTI; NTIS; GPO Dep.

Sandstone reservoirs in the Jackson barrier/strandplain play are characterized by low recovery efficiencies and thus contain a large hydrocarbon resource target potentially amenable to advanced recovery techniques. Prado field, Jim Hogg County, South Texas, has produced over 23 million bbl of oil and over 32 million mcf gas from combination structural-stratigraphic traps in the Eocene lower Jackson Group. Hydrocarbon entrapment at Prado field is a result of anticlinal nosing by differential compaction and updip pinch-out of barrier bar sandstone. Relative base-level lowering resulted in forced regression that established lower Jackson shoreline sandstones in a relatively distal location in central Jim Hogg County. Reservoir sand bodies at Prado field comprise complex assemblages of barrier-bar, tidal-inlet fill, back-barrier bar, and shoreface environments. Subsequent progradation built the barrier-bar system seaward 1 to 2 mi. With the barrier-bar system, favorable targets for hydrocarbon reexploration are concentrated in tidal-inlet facies because they possess the greatest degree of depositional heterogeneity.

27244 (LA-UR–94-1357) **Reservoir microseismicity at the Ekofisk Oil Field.** Rutledge, J.T. (Nambe Geophysical, Inc., Santa Fe, NM (United States)); Fairbanks, T.D.; Albright, J.N.; Boade, R.R.; Dangerfield, J.; Landa, G.H. Los Alamos National Lab., NM (United States). [1994]. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-940892–2: Euro rock '94, Delph (Netherlands), 9 Aug 1994). Order Number DE94014725. Source: OSTI; NTIS; GPO Dep.

A triaxial, downhole geophone was deployed within the Ekofisk oil reservoir for monitoring ambient microseismicity as a test to determine if microearthquake signals generated from discrete shear failure of the reservoir rock could be detected. The results of the test were positive. During 104 hours of monitoring, 572 discrete events were recorded which have been identified as shear-failure microearthquakes. Reservoir microseismicity was detected at large distances (1000 m) from the monitor borehole and at rates (> 5 events per hour) which may allow practical characterization of the reservoir rock and overburden deformation induced by reservoir pressure changes.

0203 Drilling and Production

Refer also to citation(s) 27240, 27241, 27242, 28504

27245 (DOE/BC–93/4) **Contracts for field projects and supporting research on enhanced oil recovery: Progress review quarter ending September 30, 1993.** USDOE, Washington, DC (United States). Aug 1994. 107p. Sponsored by USDOE, Washington, DC (United States). Order Number DE94000127. Source: OSTI; NTIS; GPO Dep.

Progress reports are presented for the following tasks: chemical flooding–supporting research; gas displacement–supporting research; thermal recovery–supporting research; geoscience technology; resource assessment technology; and field demonstrations in high-priority reservoir classes. A list of available publications is also included.

27246 (DOE/CE/15600–T2) **Method for cutting steam heat losses during cyclic steam injection of wells: Second quarterly report.** S-Cal Research Corp., San Rafael, CA (United States). [1994]. 17p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG49-93CE15600. Order Number DE94015655. Source: OSTI; NTIS; GPO Dep.

Contains article Modification for the Midway-Sunset Field of the special casing joint previously designed for the Oxnard field.

The Midway-Sunset Field (CA) is the largest Heavy Oil field in California and steam injection methods have been successfully used for more than 30 years to produce the Heavy Oil from many of its unconsolidated sand reservoirs. In partnership with another DOE/ERIP grantee, our Company has acquired an 80 ac. lease in the SE part of this field, in order to demonstrate our respective technologies in the Monarch sand, of Miocene Age, which is one of the reservoirs targeted by the DOE Class 3 Oil Program. This reservoir contains a 13 API oil, which has a much higher market value, as a Refinery Feedstock, than the 5 to 8 API Vaca Tar, used only as road paving material. This makes it easier to justify the required investment in a vertical well equipped with two horizontal drainholes. The economic viability of such a project is likely to be enhanced if Congress approves the export to Japan of a portion of the 27 API (1% Sulfur) AK North Slope oil, which currently is landed in California in preference to lighter and sweeter Far East imported crudes. This is a major cause of the depressed prices for California Heavy Oil in local refineries, which have reduced the economic viability of all EOR methods, including steam injection, in California. Two proposals, for a Near-Term (3 y.) and for a Mid-Term (6 y.) project respectively, were jointly submitted to the DOE for Field Demonstration of the Partners' new technologies under the DOE Class 3 Oil Program. The previous design of a special casing joint for the Oxnard field well was reviewed and adapted to the use of existing Downhole Hardware components from three suppliers, instead of one. The cost of drilling and completion of a well equipped with two horizontal drainholes was re-evaluated for the conditions prevailing in the Midway Sunset field, which are more favorable than in the Oxnard field, leading to considerable reductions in drilling rig time and cost.

0204 Processing

Refer also to citation(s) 27991, 27992

0207 Economic, Industrial, and Business Aspects

27247 (DOE/EIA–0109(94/07)) **Petroleum supply monthly, July 1994.** USDOE Energy Information Administration, Washington, DC (United States). Office of Oil and Gas. 26 Jul 1994. 162p. Sponsored by USDOE, Washington, DC (United States). Order Number DE94015827. Source: OSTI; NTIS; GPO Dep.

The Petroleum Supply Monthly (PSM) is one of a family of four publications produced by the Petroleum Supply Division within the Energy Information Administration (EIA) reflecting different levels of data timeliness and completeness. The other publications are the Weekly Petroleum Status Report (WPSR), the Winter Fuels Report, and the Petroleum Supply Annual (PSA). Data presented in the PSM describe the supply and disposition of petroleum products in

the United States and major US geographic regions. The data series describe production, imports and exports, inter-Petroleum Administration for Defense (PAD) District movements, and inventories by the primary suppliers of petroleum products in the United States (50 States and the District of Columbia). The reporting universe includes those petroleum sectors in primary supply. Included are: petroleum refiners, motor gasoline blenders, operators of natural gas processing plants and fractionators, inter-PAD transporters, importers, and major inventory holders of petroleum products and crude oil. When aggregated, the data reported by these sectors approximately represent the consumption of petroleum products in the United States. Data presented in the PSM are divided into two sections: Summary Statistics and Detailed Statistics.

27248 (DOE/EIA–0380(94/07)) **Petroleum marketing monthly, July 1994.** USDOE Energy Information Administration, Washington, DC (United States). Office of Oil and Gas. Jul 1994. 187p. Sponsored by USDOE, Washington, DC (United States). Order Number DE94015144. Source: OSTI; NTIS; GPO; GPO Dep.

The Petroleum Marketing Monthly (PMM) provides information and statistical data on a variety of crude oils and refined petroleum products. The publication presents statistics on crude oil costs and refined petroleum products sales for use by industry, government, private sector analysts, educational institutions, and consumers. Data on crude oil include the domestic first purchase price, the f.o.b. and landed cost of imported crude oil, and the refiners' acquisition cost of crude oil. Refined petroleum product sales data include motor gasoline, distillates, residuals, aviation fuels, kerosene, and propane. Monthly statistics on purchases of crude oil and sales of petroleum products are presented in five sections: summary statistics; crude oil prices; prices of petroleum products; volumes of petroleum products; and prime supplier sales volumes of petroleum products for local consumption. 7 figs., 50 tabs.

27249 (DOE/EIA–0520(94/07)) **International Petroleum Statistics Report, July 1994.** USDOE Energy Information Administration, Washington, DC (United States). Office of Energy Markets and End Use. 26 Jul 1994. 73p. Sponsored by USDOE, Washington, DC (United States). Order Number DE94015837. Source: OSTI; NTIS; GPO Dep.

The International Petroleum Statistics Report presents data on international oil production, demand, imports, exports, and stocks. The report has four sections. Section 1 contains time series data on world oil production, and on oil demand and stocks in the Organization for Economic Cooperation and Development (OECD). This section contains annual data beginning in 1985, and monthly data for the most recent two years. Section 2 presents an oil supply/demand balance for the world. This balance is presented in quarterly intervals for the most recent two years. Section 3 presents data on oil imports by OECD countries. This section contains annual data for the most recent year, quarterly data for the most recent two quarters, and monthly data for the most recent twelve months. Section 4 presents annual time series data on world oil production and oil stocks, demand, and trade in OECD countries. World oil production and OECD demand data are for the years 1970 through 1993; OECD stocks from 1973 through 1993; and OECD trade from 1983 through 1993. Data for the United States are developed by the Energy Information Administration's (EIA) Office of Oil and Gas. Data for other countries are derived largely from published sources, including International Energy Agency publications, the EIA International Energy Annual, and the trade press. (See sources after each section.) All data are reviewed by the International Statistics Branch of EIA. All data have been converted to units of measurement familiar to the American public. Definitions of oil production and consumption are consistent with other EIA publications.

27250 (DOE/EIA–0543(94/1Q)) **US energy industry financial developments, 1994 first quarter.** USDOE Energy Information Administration, Washington, DC (United States). Office of Energy Markets and End Use. 23 Jun 1994. 21p. Sponsored by USDOE, Washington, DC (United States). Order Number DE94015459. Source: OSTI; NTIS; GPO; GPO Dep.

This report traces key financial trends in the US energy industry for the first quarter of 1994. Financial data (only available for publicly-traded US companies) are included in two broad groups – fossil fuel production and rate-regulated electric utilities. All financial data are taken from public sources such as energy industry corporate reports and press releases, energy trade publications, and The Wall Street Journal's, Earnings Digest. Return on equity is calculated from data available from Standard and Poor's Compustat data service. Since several major petroleum companies disclose their income by lines of business and geographic area. These data are also presented in this report. Although the disaggregated income concept varies by company and is not strictly comparable to corporate income, relative movements in income by lines of business and geographic area are summarized as useful indicators of short-term changes in the underlying profitability of these operations.

27251 (DOE/EIA/TR–0568) **Costs and indices for domestic oil and gas field equipment and production operations 1990 through 1993.** USDOE Energy Information Administration, Washington, DC (United States). Office of Oil and Gas. 8 Jul 1994. 113p. Sponsored by USDOE, Washington, DC (United States). Order Number DE94015132. Source: OSTI; NTIS; GPO; INIS; GPO Dep.

This report presents estimated costs and indice for domestic oil and gas field equipment and production operations for 1990, 1991 1992, and 1993. The costs of all equipment and serives were those in effect during June of each year. The sums (aggregates) of the costs for representative leases by region, depth, and production rate were averaged and indexed. This provides a general measure of the increased or decreased costs from year to year for lease equipment and operations. These general measures do not capture changes in industry-wide costs exactly because of annual variations in the ratio of oil wells to gas wells. The body of the report contains summary tables, and the appendices contain detailed tables. Price changes for oil and gas, changes in taxes on oil and gas revenues, and environmental factors (costs and lease availability) have significant impact on the number and cost of oil and gas wells drilled. These changes also impact the cost of oil and gas production equipment and operations.

27252 (DOE/FE–0300) **Naval Petroleum and Oil Shale Reserves: Annual report of operations, Fiscal year 1993.** USDOE Assistant Secretary for Fossil Energy, Washington, DC (United States). [1993]. 62p. Sponsored by USDOE, Washington, DC (United States). Order Number DE94015884. Source: OSTI; NTIS; INIS; GPO Dep.

During fiscal year 1993, the reserves generated $440 million in revenues, a $33 million decrease from the fiscal year 1992 revenues, primarily due to significant decreases in oil and natural gas prices. Total costs were $207 million, resulting in net cash flow of $233 million, compared with $273 million in fiscal year 1992. From 1976 through fiscal year 1993, the Naval Petroleum and Oil Shale Reserves generated $15.7 billion in revenues for the US Treasury, with expenses of $2.9 billion. The net revenues of $12.8 billion represent a return on costs of 441 percent. See figures 2, 3, and 4. In fiscal year 1993, production at the Naval Petroleum and Oil Shale Reserves at maximum efficient rates yielded 25 million barrels of crude oil, 123 billion cubic feet of natural gas, and 158 million gallons of natural gas liquids. The Naval Petroleum and Oil Shale Reserves has embarked on an effort to identify additional hydrocarbon resources on the reserves for future production. In 1993, in cooperation with the US Geological Survey, the Department initiated a project to assess the oil and gas potential of the program's oil shale reserves, which remain largely unexplored. These reserves, which total a land area of more than 145,000 acres and are located in Colorado and Utah, are favorably situated in oil and gas producing regions and are likely to contain significant hydrocarbon deposits. Alternatively the producing assets may be sold or leased if that will produce the most value. This task will continue through the first quarter of fiscal year 1994.

27253 (DOE/PO–0025) **Exporting Alaskan North Slope crude oil: Benefits and costs.** USDOE, Washington, DC (United States). Jun 1994. 131p. Sponsored by USDOE, Washington, DC (United States). Order Number DE94015887. Source: OSTI; NTIS; INIS; GPO Dep.

The Department of Energy study examines the effects of lifting the current prohibitions against the export of Alaskan North Slope (ANS) crude. The study concludes that permitting exports would benefit the US economy. First, lifting the ban would expand the

markets in which ANS oil can be sold, thereby increasing its value. ANS oil producers, the States of California and Alaska, and some of their local governments all would benefit from increased revenues. Permitting exports also would generate new economic activity and employment in California and Alaska. The study concludes that these economic benefits would be achieved without increasing gasoline prices (either in California or in the nation as a whole). Lifting the export ban could have important implications for US maritime interests. The Merchant Marine Act of 1970 (known as the Jones Act) requires all inter-coastal shipments to be carried on vessels that are US-owned, US-crewed, and US-built. By limiting the shipment of ANS crude to US ports only, the export ban creates jobs for the seafarers and the builders of Jones Act vessels. Because the Jones Act does not apply to exports, however, lifting the ban without also changing US maritime law would jeopardize the jobs associated with the current fleet of Jones Act tankers. Therefore the report analyzes selected economic impacts of several maritime policy alternatives, including: Maintaining current law, which allows foreign tankers to carry oil where export is allowed; requiring exports of ANS crude to be carried on Jones Act vessels; and requiring exports of ANS crude to be carried on vessels that are US-owned and US-crewed, but not necessarily US-built. Under each of these options, lifting the export ban would generate economic benefits.

0208 Waste Management

Refer also to citation(s) 27256

0209 Environmental Aspects

Refer also to citation(s) 27254, 28489

27254 (DOE/EIS–0158-S) **Naval Petroleum Reserve No. 1 (Elk Hills): Supplemental environmental impact statement: Record of decision.** USDOE Naval Petroleum Reserves in California, Tupman, CA (United States). Feb 1994. 20p. Sponsored by USDOE, Washington, DC (United States). Order Number DE94015408. Source: OSTI; NTIS; GPO Dep.

Pursuant to the Council on Environmental Quality regulations, which implement the procedural provisions of the National Environmental Policy Act, and the US Department of Energy National Environmental Policy Act regulations, the Department of Energy, Office of Fossil Energy, is issuing a Record of Decision on the continued operation of Naval Petroleum Reserve No. 1, Kern County, California. The Department of Energy has decided to continue current operations at Naval Petroleum Reserve No. 1 and implement additional well drilling, facility development projects and other activities necessary for continued production of Naval Petroleum Reserve No. 1 in accordance with the requirements of the Naval Petroleum Reserves Production Act of 1976. The final Supplemental Environmental Impact Statement, entitled "Petroleum Production at Maximum Efficient Rate, Naval Petroleum Reserve No. 1 (Elk Hills), Kern County, California (DOE/SEIS-0158)," was released on September 3, 1993.

0220 Transport, Handling, and Storage

27255 (DOE/FE–0313) **Strategic petroleum reserve: Quarterly report.** USDOE Assistant Secretary for Fossil Energy, Washington, DC (United States). Office of Strategic Petroleum Reserve. 15 May 1994. 13p. Sponsored by USDOE, Washington, DC (United States). Order Number DE94015885. Source: OSTI; NTIS; GPO Dep.

The Strategic Petroleum Reserve serves as one of our most important investments in reducing the Nation's vulnerability to oil supply disruptions. Its existence provides an effective response mechanism should a disruption occur and a formidable deterrent to the use of oil as a political instrument. The Strategic Petroleum Reserve was created pursuant to the Energy Policy and Conservation Act of December 22, 1975, (Public Law 94-163) as amended, to reduce the impact of disruptions in supplies of petroleum products and to carry out obligations of the United States under the Agreement on an International Energy Program. Section 165(a) of the Act requires the submission of Annual Reports and Section 165(b)(1) requires the submission of Quarterly Reports. This Quarterly Report highlights activities undertaken during the first quarter of calendar year 1994, including: (1) inventory of petroleum products stored in the Reserve, under contract and in transit at the end of the calendar quarter; (2) fill rate for the current quarter and projected fill rate for the next calendar quarter; (3) average price of the petroleum products acquired during the calendar quarter; (4) current and projected storage capacity; (5) analysis of existing or anticipated problems with the acquisition and storage of petroleum products, and future expansion of storage capacity; (6) funds obligated by the Secretary from the SPR Petroleum Account and the Strategic Petroleum Reserve Account during the prior calendar quarter and in total; and (7) major environmental actions completed, in progress, or anticipated.

27256 (SAND–93-4031) **Stability evaluation of the Markel Mine at Weeks Island, Louisiana.** Hoffman, E.L. Sandia National Labs., Albuquerque, NM (United States). Jun 1994. 40p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. Order Number DE94016146. Source: OSTI; NTIS; GPO Dep.

A three dimensional (3D) finite element analysis of the Markel Mine located on Weeks Island was performed to: (1) evaluate the stability of the mine and (2) determine the effect of mine failure on the nearby Morton Salt mine and SPR facilities. The first part of the stability evaluation investigates the effect of pillar failure on mine stability. These simulations revealed that tensile stresses and dilatant damage develop in the overlying salt as a result of pillar loss. These tensile stresses extend to the salt/overburden interface only for the case where all 45 of the pillars are assumed to fail. Tensile stresses would likely cause microfracturing of the salt, resulting in a flow path for groundwater from the overlying aquifer to enter the mine. The dilatant damage bridges between the mine and the overburden in the case where 15 or more pillars are removed from the model. Dilatant damage is attributed to microfracturing or changes in the pore structure of the salt and could also result in a flow path for groundwater to enter the mine. The second part of the Markel Mine evaluation investigates the stability of the pillars with respect to three failure mechanisms: tensile failure, compressive failure, and creep rupture. A 3D slabbing pillar model of the Markel mine was developed to investigate progressive failure of the pillars and the effect of slabbing on mine stability. Based on a strain-limiting creep rupture criterion, pillar failure is predicted to be extensive at present. The associated loss of pillar strength should be equivalent to removing all pillars from the model as was done in the first part of this stability analysis, resulting in the possibility of ground water intrusion. Since creep rupture is not a well understood phenomenon, further development and validation of this criterion is recommended.

0230 Properties and Composition

27257 (NREL/TP–425-6355) **Diesel fuel component contributions to engine emissions and performance: Clean fuel study.** Erwin, J. (Southwest Research Inst., San Antonio, TX (United States)); Ryan, T.W. III; Moulten, D.S. National Renewable Energy Lab., Golden, CO (United States); Southwest Research Inst., San Antonio, TX (United States). Aug 1994. 49p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC36-83CH10093. Order Number DE94011868. Source: OSTI; NTIS; GPO Dep.

The emissions characteristics of diesel engines are dominated by current engine design parameters as long as the fuels conform to the current industry-accepted specifications. The current and future emissions standard, are low enough that the fuel properties and compositions are starting to play a more significant role in meeting the emerging standards. The potential role of the fuel composition has been recognized by state and federal government agencies, and for the first time, fuel specifications have become part of the emissions control legislation. In this work, five different fuel feed and blend stocks were hydrotreated to two levels of sulfur and aromatic content. These materials were then each distilled to seven or eight fractions of congruent boiling points. After this, the

raw materials and all of the fractions were characterized by a complement of tests from American Society for Testing and Materials and by hydrocarbon-type analyses. The sample matrix was subjected to a series of combustion bomb and engine tests to determine the ignition, combustion, and emissions characteristics of each of the 80 test materials.

0250 Combustion

Refer also to citation(s) 27256

03 NATURAL GAS

0302 Reserves, Geology, and Exploration

Refer also to citation(s) 27242

27258 (DOE/MC/28130–3721) **Reserves in Western Basins, Greater Green River Basin, Paradox core data files.** Caldwell, R.H. Scotia Group, Inc., Dallas, TX (United States). May 1994. 56p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC21-91MC28130. Order Number DE94004109. Source: OSTI; NTIS; GPO Dep.

Includes 3 disks.

As part of the deliverables for Phase I of this project, Greater Green River Basin, are the base digital data set developed as part of the study. The floppy disks, attached to this report contain this information. The report consists of FINHEAD–Description of all wells in the study. FINPERF–Perforations and productive characteristics for all wells in the study. NEWCORE–Ambient core data for selected wells in the study. NEWCOREX–In-Situ corrected core data for the same wells. Individual files have the following suffixes: DB–The database files themselves. PX–Indexing file into the database file. R–Report format for the database file. RPT–Report of the data in ASCII format. This report contains data from the FINHEAD.RPT and NEWCORES.RPT files. The digital data represents all selected wells within the greater Green River Basin that were interpreted to have penetrated the overpressured tight section. This excludes certain areas within the basin, such as the Moxa Arch, were the USGS did not conduct an analysis due to the complexity of the situation as described in our final report. The core data has been expressed in two forms. The first is the base core analysis data as collected measured at ambient conditions. The second version represents the same data for the same wells but porosities and permeabilities have been corrected to represent in-situ conditions. For porosity, this involves an overburden correction and for permeability, correction for gas slippage (Klinkenberg), and other overburden related corrections as described in our final report.

0303 Drilling, Production, and Processing

Refer also to citation(s) 27620

27259 (DOE/METC/C–94/7126) **Development of advanced drilling, completion, and stimulation systems for minimum formation damage and improved efficiency: A program overview.** Layne, A.W.; Yost, A.B. II. USDOE Morgantown Energy Technology Center, WV (United States). [1994]. 13p. Sponsored by USDOE, Washington, DC (United States). (CONF-940291–1: Society of Petroleum Engineers (SPE) formation damage control symposium, Lafayette, LA (United States), 7-10 Feb 1994). Order Number DE94015150. Source: OSTI; NTIS; GPO Dep.

The Department of Energy's (DOE) Natural Gas Resource and Extraction Program consists of industry/government co-sponsored research, development, and demonstration (RD&D) projects, which focus on gas recovery from both conventional and nonconventional resources. The Drilling, Completion, and Stimulation (DCS) Project focuses on advanced, non-damaging technology systems and equipment for improving gas recovery from conventional and nonconventional reservoirs. As operators move from development of current day economically attractive gas-field development to the lower permeability geologic regions of domestic onshore plays, increasing the emphasis on minimum formation damage DCS will permit economic development of gas reserves. The objective of the Project is to develop and demonstrate cost-effective, advanced technology to accelerate widespread use and acceptance of minimum formation damage DCS systems. The goal of this product development effort is to reduce costs and improve the overall efficiency of vertical, directional, and horizontally drilled wells in gas formations throughout the US. The current focus of the Project is on the development of underbalanced drilling technology and minimum formation damage stimulation technology concurrently with the appropriate completion hardware to improve the economics of domestic natural gas field development. Ongoing drilling technology projects to be discussed include development of an electromagnetic measurement while drilling system for directional and horizontal drilling in underbalanced drilling applications and the development of a steerable air percussion drilling system for hard formation drilling and improved penetration rates. Ongoing stimulation technology projects to be discussed include introduction of carbon dioxide/sand fracturing technology for minimal formation damage.

0304 Products and By-Products

Refer also to citation(s) 27580

0306 Economic, Industrial, and Business Aspects

Refer also to citation(s) 27239, 27249, 27250

27260 (DOE/EIA–0130(94/06)) **Natural gas monthly, June 1994.** USDOE Energy Information Administration, Washington, DC (United States). Office of Oil and Gas. Jun 1994. 113p. Sponsored by USDOE, Washington, DC (United States). Order Number DE94012255. Source: OSTI; NTIS; GPO; GPO Dep.

The Natural Gas Monthly (NGM) highlights activities, events, and analyses of interest to public and private sector organizations associated with the natural gas industry. Volume and price data are presented each month for natural gas production, distribution, consumption, and interstate pipeline activities. Producer-related activities and underground storage data are also reported. From time to time, the NGM features articles designed to assist readers in using and interpreting natural gas information. The feature article this month is the executive summary from Natural Gas 1994: Issues and Trends. 6 figs., 31 tabs.

27261 (DOE/EIA–0130(94/07)) **Natural gas monthly, July 1994.** USDOE Energy Information Administration, Washington, DC (United States). Office of Oil and Gas. 20 Jul 1994. 105p. Sponsored by USDOE, Washington, DC (United States). Order Number DE94015717. Source: OSTI; NTIS; GPO; GPO Dep.

The Natural Gas Monthly (NGM) highlights activities, events, and analyses of interest to public and private sector organizations associated with the natural gas industry. Volume and price data are presented each month for natural gas production, distribution, consumption, and interstate pipeline activities. Producer-related activities and underground storage data are also reported. From time to time, the NGM features articles designed to assist readers in using and interpreting natural gas information.

27262 (DOE/EIA–0542(95)) **Natural gas productive capacity for the lower 48 States, 1980 through 1995.** USDOE Energy Information Administration, Washington, DC (United States). Office of Oil and Gas. 14 Jul 1994. 120p. Sponsored by USDOE, Washington, DC (United States). Order Number DE94016592. Source: OSTI; NTIS; INIS; GPO Dep.

The purpose of this report is to analyze monthly natural gas wellhead productive capacity in the lower 48 States from 1980 through 1992 and project this capacity from 1993 through 1995. For decades, natural gas supplies and productive capacity have been adequate to meet demand. In the 1970's the capacity surplus was small because of market structure (split between interstate and intrastate), increasing demand, and insufficient drilling. In the early 1980's, lower demand, together with increased drilling, led to a large surplus capacity as new productive capacity came on line. After 1986, this large surplus began to decline as demand for gas increased, gas prices fell, and gas well completions dropped

sharply. In late December 1989, the decline in this surplus, accompanied by exceptionally high demand and temporary weather-related production losses, led to concerns about the adequacy of monthly productive capacity for natural gas. These concerns should have been moderated by the gas system's performance during the unusually severe winter weather in March 1993 and January 1994. The declining trend in wellhead productive capacity is expected to be reversed in 1994 if natural gas prices and drilling meet or exceed the base case assumption. This study indicates that in the low, base, and high drilling cases, monthly productive capacity should be able to meet normal production demands through 1995 in the lower 48 States (Figure ES1). Exceptionally high peak-day or peak-week production demand might not be met because of physical limitations such as pipeline capacity. Beyond 1995, as the capacity of currently producing wells declines, a sufficient number of wells and/or imports must be added each year in order to ensure an adequate gas supply.

27263 (DOE/FE–0312) **Natural gas imports and exports: First quarter report 1994.** USDOE Assistant Secretary for Fossil Energy, Washington, DC (United States). Office of Fuels Programs. [1994]. 174p. Sponsored by USDOE, Washington, DC (United States). Order Number DE94015883. Source: OSTI; NTIS; GPO Dep.

The Office of Fuels Programs Prepares quarterly reports Summarizing the data provided by companies authorized to import or export natural gas. Companies are required, as a condition of their authorizations, to file quarterly reports with the OFP. This report is for the first quarter of 1994 (January–March). Attachment A shows the percentage of takes to maximum firm contract levels and the weighted average per unit price for each of the long-term importers during the five most recent reporting quarters. Attachment B shows volumes and prices of gas purchased by long-term importers and exporters during the past twelve months. Attachment C shows volume and price information for gas imported on a short-term basis. Attachment D shows the gas exported on a short-term basis to Canada and Mexico. During the first three months of 1994, data indicates that gas imports grew by about 14 percent over the level of the first quarter of 1993 (668 vs. 586 Bcf), with Canadian and Algerian imports increasing by 12 and 53 percent, respectively. During the same time period, exports declined by 15 percent (41 vs. 48 Bcf). Exports to Canada increased by 10 percent from the 1993 level (22 vs. 20 Bcf) and exports to Mexico decreased by 64 percent (5 vs. 14 Bcf).

27264 (ETDE-GB–630) **Report and accounts for the year ended 31 December 1993.** British Gas plc, London (United Kingdom). 1994. 57p. Order Number DE94787531. Source: OSTI; NTIS (US Sales Only); INIS.

The document contains the Annual Report and Accounts for British Gas, the United Kingdom gas utility, for the financial year ended 31st December 1992. Government policies have meant that there is more competition in the contract sector of the UK gas market. British Gas has responded with a major restructuring in the UK and many initiatives to increase business overseas in many parts of the world. These projects are documented briefly. (UK)

04 OIL SHALES AND TAR SANDS

0404 Oil Production, Recovery, and Refining

27265 (DOE/BC/14479–T1) **Chemically assisted in situ recovery of oil shale: [Quarterly report], April 1, 1990–June 30, 1990.** Ramirez, W.F. Colorado Univ., Boulder, CO (United States). Dept. of Chemical Engineering. [1990]. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC22-89BC14479. Order Number DE94015875. Source: OSTI; NTIS; GPO Dep.

The objective of this work is to investigate, in the laboratory, the parameters associated with a chemically assisted in situ recovery procedure, using hydrogen chloride (HCl), carbon dioxide (CO_2), and steam (H_2O), to obtain-data useful to develop a process more economic than existing processes and to report all findings. The technical progress of the project is reported. The progress of the project is that experiment preparations are underway. Reactor design, process design, and experiment design have been completed. The laboratory to be used has required extensive clean-up, and is nearly ready. Safety considerations are underway. Finally, an initial literature search has revealed some important aspects that need to be considered.

27266 (DOE/BC/14479–T2) **Chemically assisted in situ recovery of oil shale: [Quarterly report], October 1, 1991–December 31, 1991.** Ramirez, W.F. Colorado Univ., Boulder, CO (United States). Dept. of Chemical Engineering. [1991]. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC22-89BC14479. Order Number DE94015876. Source: OSTI; NTIS; GPO Dep.

The objective of this work is to investigate, in the laboratory, the parameters associated with a chemically assisted in situ recovery procedure, using hydrogen chloride (HCl), carbon dioxide (CO_2), and steam (H_2O), to obtain data useful to develop a process more economic than existing processes and to report all findings. The technical progress of the project is reported. The project status is that the solutions to the problems discussed in the third quarter status, were found to function satisfactorily. Future needs have been considered, and appropriate equipment and instrumentation changes have been designed. Only one experiment was performed this quarter, with some improvement over the previous experiments. The increase in shale oil recovery followed directly from the changes discussed last quarter, but the improvement could have been larger with wider-spread implementation of the changes. Equipment was purchased to rectify the need, and will be installed shortly. Further, a minor change in the design was necessary to account for the brittleness of high temperature electrical resistance heating tapes. The focus of the work this quarter has been on the development of computer software to enable the use of on-line parameter identification, the design of the instrumentation necessary to adequately observe the system, and the design of a continuous gas mixer to implement the experiment.

0408 Economic, Industrial, and Business Aspects

Refer also to citation(s) 27239, 27251

05 NUCLEAR FUELS

Refer also to citation(s) 27636

0501 Reserves, Exploration, and Mining

27267 (JAERI-M–94-061) **Status of natural analogue studies: Based on the results obtained by JAERI.** Sekine, Keiichi (Japan Atomic Energy Research Inst., Tokai, Ibaraki (Japan). Tokai Research Establishment). Japan Atomic Energy Research Inst., Tokyo (Japan). Mar 1994. 26p. (In Japanese). Order Number DE94785243. Source: OSTI; NTIS; INIS.

This report is based on the materials for the meeting at the Nuclear Safety Commission of Japan held on September 1993. Details are as follows: Alteration of glass as the study of alteration of natural minerals; alteration of uranium minerals, migration of uranium and thorium series radionuclides, alteration of chlorite, fixation of uranium alteration of minerals and migration of uranium as the study of alligator rivers analogue project held at Koongarra uranium deposit, Australia. (author).

0504 Feed Processing

Refer also to citation(s) 27490

0505 Uranium Enrichment

Refer also to citation(s) 27468

0507 Fuels Production and Properties

Refer also to citation(s) 27682, 27769, 28002

27268 (BNWL-CC–907) **Recovery of transplutonium elements from Redox waste.** Roberts, F.P.; Bray, L.A. Pacific Northwest Lab., Richland, WA (United States). 1 Dec 1966. 13p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE94015444. Source: OSTI; NTIS; GPO Dep.

Processing of the Shippingport blanket in the Redox Plant to recover Pu, U, and Np will generate wastes containing valuable quantities of americium and curium. The isolation of these values by co-precipitation with the rare earths as double sulfates has been proposed. The double sulfate process is being used effectively for rare earth recovery with the Purex acid waste but it is known that poor recoveries are obtained from current Redox waste from processing Hanford fuel elements. Aluminum nitrate is used as a salting agent in the Redox process and as a result the wastes cannot be concentrated. For this reason, the rare earth concentration in the Redox waste is far too low to precipitate the sulfates with good yields. The Purex process, however, uses nitric acid as a salting agent. These wastes can be boiled down to a volume which will permit good recovery by the sulfate process. For the high exposure of the Shippingport blanket, or any power reactor fuel., the rare earth concentration in the waste will be much higher and adequate actinide recovery is possible in either Redox or Purex. This report describes the studies to adapt the sulfate process to Redox high exposure fuels waste and to measure the degree of actinide carrying on rare earth double sulfates.

27269 (DOE/ID–10422-Vol.4) **Weapons-grade plutonium dispositioning. Volume 4: Plutonium dispositioning in light water reactors.** Sterbentz, J.W.; Olsen, C.S.; Sinha, U.P. Idaho National Engineering Lab., Idaho Falls, ID (United States). Jun 1993. 98p. Sponsored by USDOE, Washington, DC (United States);National Academy of Sciences, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE94015249. Source: OSTI; NTIS; INIS; GPO Dep.

This study is in response to a request by the Reactor Panel Subcommittee of the National Academy of Sciences (NAS) Committee on International Security and Arms Control (CISAC) to evaluate the feasibility of using plutonium fuels (without uranium) for disposal in existing conventional or advanced light water reactor (LWR) designs and in low temperature/pressure LWR designs that might be developed for plutonium disposal. Three plutonium-based fuel forms (oxides, aluminum metallics, and carbides) are evaluated for neutronic performance, fabrication technology, and material and compatibility issues. For the carbides, only the fabrication technologies are addressed. Viable plutonium oxide fuels for conventional or advanced LWRs include plutonium-zirconium-calcium oxide (PuO_2-ZrO_2-CaO) with the addition of thorium oxide (ThO_2) or a burnable poison such as erbium oxide (Er_2O_3) or europium oxide (Eu_2O_3) to achieve acceptable neutronic performance. Thorium will breed fissile uranium that may be unacceptable from a proliferation standpoint. Fabrication of uranium and mixed uranium-plutonium oxide fuels is well established; however, fabrication of plutonium-based oxide fuels will require further development. Viable aluminum-plutonium metallic fuels for a low temperature/pressure LWR include plutonium aluminide in an aluminum matrix ($PuAl_4$-Al) with the addition of a burnable poison such as erbium (Er) or europium (Eu). Fabrication of low-enriched plutonium in aluminum-plutonium metallic fuel rods was initially established 30 years ago and will require development to recapture and adapt the technology to meet current environmental and safety regulations. Fabrication of high-enriched uranium plate fuel by the picture-frame process is a well established process, but the use of plutonium would require the process to be upgraded in the United States to conform with current regulations and minimize the waste streams.

27270 (HAN–93855-Rpt.5) **200 Area monthly report, May 1966: Report No. 5.** Christy, J.T. General Electric Co., Richland, WA (United States). Hanford Atomic Products Operation. 13 Jun 1966. 16p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE94015450. Source: OSTI; NTIS; GPO Dep.

This report details 200 Area activities for the month of May 1966.

27271 (HW–74096) **The application of an operational reactivity accounting system based on one-group diffusion theory.** Stewart, S.L. Pacific Northwest Lab., Richland, WA (United States). 2 Jul 1962. 19p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE94015979. Source: OSTI; NTIS; GPO Dep.

HW-70780, "An Operational Reactivity Accounting System Based on One-Group Diffusion Theory" describes a reactivity accounting system which is an improvement over the present "flux-squared weighting" system. Several changes and additions have been made which will simplify and increase the accuracy of the system described in the parent document. The changes occur primarily in the application of the system and are compatible with diffusion theory and the parent document. Each change will be described briefly and to illustrate their application an example reactivity balance, using the reactivity accounting system, will be performed.

27272 (LA-UR–94-2408) **A combined experimental and modeling approach to uranium casting.** Korzekwa, D.; Dunn, P. Los Alamos National Lab., NM (United States). [1994]. 10p. Sponsored by Department of Defense, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-940978–2: Symposium on liquid metal processing and casting, Santa Fe, NM (United States) 11-14 Sep 1994). Order Number DE94016289. Source: OSTI; NTIS; GPO Dep.

U casting was studied using a combined experimental and modeling approach; the U is cast into graphite molds using vacuum induction melting. Mold design and process parameters were varied. FLOW-3D and ABAQUS codes were used. Temperature predictions were compared with experimental data from thermcouples in the mold; initial metal and mold temperatures were used in input to FLOW-3D. Fluid flow predictions were validated using static and dynamic radiographic data. Dynamic radiographic videos of gold castings were compared to 3D simulations.

27273 (PNL–9965) **Cost update: Technology, safety, and costs of decommissioning a reference uranium fuel fabrication plant.** Miles, T.L.; Liu, Y. Pacific Northwest Lab., Richland, WA (United States). Jun 1994. 54p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE94015285. Source: OSTI; NTIS; INIS; GPO Dep.

The cost estimates originally developed in NUREG/CR-1266 for commissioning a reference low-enrichment uranium fuel fabrication plant are updated from 1978 to early 1993 dollars. During this time, the costs for labor and materials increased approximately at the rate of inflation, the cost of energy increased more slowly than the rate of inflation, and the cost of low-level radioactive waste disposal increased much more rapidly than the rate of inflation. The results of the analysis indicate that the estimated costs for the immediate dismantlement and decontamination for unrestricted facility release (DECON) of the reference plant have increased from the mid-1978 value of $3.57 million to $8.08 million in 1993 with incompact low-level radioactive waste disposal at the US Ecoloay facility near Richland, Washington. The cost estimate rises to $19.62 million with out-of-compact radioactive waste disposal at the Chem-Nuclear facility near Barnwell, South Carolina. A methodology and a formula are presented for estimating the cost of decommissioning the reference uranium fuel fabrication plant at some future time, based on these early 1993 cost estimates. The formula contains essentially the same elements as the formula given in 10 CFR 50.75 for escalating the decommissioning costs for nuclear power reactors to some future time.

27274 (SR/H–746) **Technical Department report on Production Test No. 313-40-M: Machinability of heavy metal.** Grills, R.C. Du Pont de Nemours (E.I.) and Co., Aiken, SC (United States). 19 Jan 1945. 3p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-76SR00001. Order Number DE94014642. Source: OSTI; NTIS; GPO Dep.

Short communication. METALS/machining; METALS; MACHINING; TEMPERATURE DEPENDENCE; TEMPERATURE RANGE; TESTING; HANFORD RESERVATION

0508 Spent Fuels Reprocessing

Refer also to citation(s) 27429, 27529, 27530, 27538, 27549, 27673, 27756, 28016

27275 (ANL/TD/CP–82182) **Status of the Integral Fast Reactor fuel cycle demonstration and waste management practices.** Benedict, R.W.; Goff, K.M.; McFarlane, H.F. Argonne National Lab., Idaho Falls, ID (United States). [1994]. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-940815–74: International nuclear and hazardous waste management conference, Atlanta, GA (United States), 14-18 Aug 1994). Order Number DE94015065. Source: OSTI; NTIS; INIS; GPO Dep.

Over the past few years, Argonne National Laboratory has been preparing for the demonstration of the fuel cycle for the Integral Fast Reactor (IFR), an advanced reactor concept that takes advantage of the properties of metallic fuel and liquid metal cooling to offer significant improvements in reactor safety and operations, fuel-cycle economics, environmental protection, and safeguards. The IFR fuel cycle, which will be demonstrated at Argonne-West in Idaho, employs a pyrometallurgical process using molten salts and liquid metals to recover actinides from spent fuel. The required facility modifications and process equipment for the demonstration are nearing completion. Their status and the results from initial fuel fabrication work, including the waste management aspects, are presented. Additionally, estimated compositions of the various process waste streams have been made, and characterization and treatment methods are being developed. The status of advanced waste processing equipment being designed and fabricated is described.

27276 (JAERI–1331) **EXTRA·M: a computing code system for analysis of the Purex process with mixer settlers for reprocessing.** Tachimori, Shoichi (Japan Atomic Energy Research Inst., Tokai, Ibaraki (Japan). Tokai Research Establishment). Japan Atomic Energy Research Inst., Tokyo (Japan). Mar 1994. 188p. (In Japanese). Order Number DE94785273. Source: OSTI; NTIS; INIS.

A computer code system EXTRA·M, for simulation of transient behavior of the solutes in a multistage countercurrent extraction process, was developed aiming to predict the distribution and chemical behaviors of actinide elements, i.e., U, Pu, Np, and of technetium in the Purex process of fuel reprocessing. The mathematical model is applicable to a complete mixing stagewise contactor such as mixer settler and to the Purex, with tri-n-butylphosphate (TBP) and nitric acid system. The main characteristics of the EXTRA·M are as follows; (i) Calculation of distribution ratios of the solutes is based on numerical equations of which parameter values are to be determined by a best fit method with a number of experimental data. (ii) Total of 18 solutes; U(IV), U(VI), Pu(III), Pu(IV), Pu(V), Pu(VI), Np(IV), Np(V), Np(VI), Tc(IV), Tc(V), Tc(VI), Tc(VII), Zr(IV), HNO_3, hydrazine, hydroxylamine nitrate and nitrous acid, are treated and rate equations of total 40 chemical reactions involving these solutes are incorporated. (iii) Instantaneous change of flow conditions, i.e., concentration of the solutes and flow rate of the feeding solutions, is contrived by computation. (iv) Reflux or bypass mode calculation, in which an aqueous raffinate stream is transferred to the preceding bank or stage, is possible. The present report explains the concept, assumptions and characteristics of the model, the material balance equations including distribution and reaction rate equations and their solution method, and the usefulness of the model by showing some examples of the verification results. A description and source program of EXTRA·M1, as an example, are listed in the annex. (J.P.N.) 63 refs.

27277 (LA-UR–94-2400) **Chromium in aqueous nitrate plutonium process streams: Corrosion of 316 stainless steel and chromium speciation.** Smith, W.H.; Purdy, G. Los Alamos National Lab., NM (United States). [1994]. 36p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. Order Number DE94016288. Source: OSTI; NTIS; INIS; GPO Dep.

According to the measurements made in this study, the only situation in which chromium (+6) could exist in a plutonium process solution is one in which a feed containing chromium is dissolved in a glass pot dissolver in high nitric acid concentration and at high temperature. But when the resulting feed is prepared for ion exchange, the chemical treatment reduces chromium to the +3 state. Any solution being processed through the evaporator will only contain chromium in the +3 state and any chromium salts remaining in the evaporator bottoms will be chromium +3 salts.

0509 Transport, Handling, and Storage

Refer also to citation(s) 27398, 27523, 27917, 28014, 28017, 28019

27278 (ANL/ESD/TM–68) **Longitudinal review of state-level accident statistics for carriers of interstate freight.** Saricks, C.; Kvitek, T. Argonne National Lab., IL (United States). Mar 1994. 45p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. Order Number DE94016625. Source: OSTI; NTIS; INIS; GPO Dep.

State-level accident rates by mode of freight transport have been developed and refined for application to the US Department of Energy's (DOE's) environmental mitigation program, which may involve large-quantity shipments of hazardous and mixed wastes from DOE facilities. These rates reflect multi-year data for interstate-registered highway earners, American Association of Railroads member carriers, and coastal and internal waterway barge traffic. Adjustments have been made to account for the share of highway combination-truck traffic actually attributable to interstate-registered carriers and for duplicate or otherwise inaccurate entries in the public-use accident data files used. State-to-state variation in rates is discussed, as is the stability of rates over time. Computed highway rates have been verified with actual carriers of high- and low-level nuclear materials, and the most recent truck accident data have been used, to ensure that the results are of the correct order of magnitude. Study conclusions suggest that DOE use the computed rates for the three modes until (1) improved estimation techniques for highway combination-truck miles by state become available; (2) continued evolution of the railroad industry significantly increases the consolidation of interstate rail traffic onto fewer high-capacity trunk lines; or (3) a large-scale offsite waste shipment campaign is imminent.

27279 (CONF-940212–1) **Initial estimates of samples and residues requiring transport arising from the US Department of Energy's analytical services program.** Pope, R.B. (Oak Ridge National Lab., TN (United States)); Bisaria, A.; Michelhaugh, R.D.; Conroy, M.J. Oak Ridge National Lab., TN (United States). [1994]. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From Seminar on developments in radioactive waste transport; Vienna (Austria); 21-25 Feb 1994. Order Number DE94009176. Source: OSTI; NTIS; INIS; GPO Dep.

The US Department of Energy (DOE) has created the Office of Environmental Restoration and Waste Management (EM) to address the diverse complex problems associated with the remediation of DOE sites. Included in the EM office are two companion divisions that are playing vital roles in preparing, monitoring and implementing the remediation process. These divisions are the Transportation Management Division (TMD) and the Laboratory Management Division (LMD). A large number of shipments to and from the laboratories performing sample analysis will be required. The materials to be shipped will usually be hazardous, and many of them will be radioactive. The LMD has issued initial detailed plans for proceeding in this effort. This includes the development of a 5-year plan, and progress toward the scoping of sample needs on a site-by-site basis. As a result, the packaging and transportation planning by TMD, in support of LMD, has now begun in earnest. The initial efforts and findings, in terms of initial estimates of materials to be shipped, are provided in this paper. Issues relating to package design which have been identified are briefly discussed.

27280 (DOE/RW–0444) **OCRWM Bulletin, August 1994.** USDOE Office of Civilian Radioactive Waste Management, Washington, DC (United States). Aug 1994. 4p. Sponsored by USDOE, Washington, DC (United States). Source: OSTI (Free of Charge); INIS.

The Civilian Radioactive Waste Management Program undertook a major initiative on June 3, 1994, by requesting proposals for a multi-purpose canister (MPC) system. The purpose of the system is to provide a standardized system for storage, transportation, and disposal of spent nuclear fuel. Among the advantages of the MPC concept two stand out. First, and most important, the system reduces handling of individual spent fuel assemblies. Second, it promotes standardization and compatibility among storage technologies used at civilian reactor storage sites and Department of Energy facilities. If used by the majority of reactors, the MPC will

reduce total number of shipments and the overall waste management system costs for nuclear energy utilities and the Federal Government. The MPC concept calls for a sealed metal canister that can hold many spent fuel assemblies from a nuclear powerplant. The MPC system will be designed to provide criticality control, heat transfer, and structural support during storage and transportation of spent nuclear fuel. The canister will be placed inside separate units or "over-packs" for shipment, storage, and disposal. Nuclear Regulatory Commission (NRC) certificates of compliance are required for the MPC systems for storage and transportation . Ultimately, the waste package, which includes the MPC, systems for storage and transportation. Ultimately, the waste package, which includes the MPC, must be licensed by the NRC for disposal in a repository.

27281 (INIS-JP–018, pp. 323-327) **The current status of nuclear fuel transport in Japan.** Aoki, Shigebumi (Tokyo Inst. of Tech. (Japan)); Fukuda, Satoshi; Tsuji, Ichiro; Kuno, Hikoshiro. 1993. 1709p. (CONF-920905–: PATRAM '92: 10th international symposium on the packaging and transportation of radioactive materials, Yokohama (Japan), 13-18 Sep 1992). In *The 10th international symposium on the packaging and transportation of radioactive materials: Proceedings.* Order Number DE94737964. Source: OSTI; NTIS; INIS.

Composed of three volumes.

Short communication. NUCLEAR FUELS/maritime transport; JAPAN; TRANSPORT REGULATIONS; RADIATION PROTECTION; WASTE TRANSPORTATION; PACKAGING; NUCLEAR POWER PLANTS; ISOTOPE SEPARATION PLANTS; PLUTONIUM; SPENT FUELS; FUEL REPROCESSING PLANTS

27282 (INIS-JP–018, pp. 328-335) **Thirty years of safe irradiated fuel transport maintaining the record.** Pannett, R.F. (Nuclear Electric plc., Bedminster Down (United Kingdom)); Barnfield, J.H. 1993. 1709p. (CONF-920905–: PATRAM '92: 10th international symposium on the packaging and transportation of radioactive materials, Yokohama (Japan), 13-18 Sep 1992). In *The 10th international symposium on the packaging and transportation of radioactive materials: Proceedings.* Order Number DE94737964. Source: OSTI; NTIS; INIS.

Composed of three volumes.

The paper reviews the evolution of the design of the Magnox and AGR flasks over 30 years and outlines Nuclear Electric's operational arrangements including its system for collecting and responding to reports on any operating difficulties found with the flasks, and also the Nuclear Electric administered emergency response plan for the provision of assistance at the site of any accident involving a flask in transit. (J.P.N.).

27283 (INIS-JP–018, pp. 336-342) **Integration of packaging design and planning into transportation.** Jarrell, R.F. (USDOE Richland Field Office, WA (United States)). 1993. 1709p. (CONF-920905–: PATRAM '92: 10th international symposium on the packaging and transportation of radioactive materials, Yokohama (Japan), 13-18 Sep 1992). In *The 10th international symposium on the packaging and transportation of radioactive materials: Proceedings.* Order Number DE94737964. Source: OSTI; NTIS; INIS.

Composed of three volumes.

In the past, numerous programs, projects, and design concepts for packaging and materials production have taken place without all the principal participants being involved in the up-front planning process. Many major facilities and packagings have been designed without the involvement of Transportation professionals. Unfortunately, Transportation has been overlooked and in most cases is a critical element that should have been included in the Planning process. (J.P.N.).

27284 (INIS-JP–018, pp. 353-358) **Transportation of high-level waste and spent fuel.** Carlson, J.H. (USDOE, Washington, DC (United States)); Lake, W.H.; Thompson, J.H. 1993. 1709p. (CONF-920905–: PATRAM '92: 10th international symposium on the packaging and transportation of radioactive materials, Yokohama (Japan), 13-18 Sep 1992). In *The 10th international symposium on the packaging and transportation of radioactive materials: Proceedings.* Order Number DE94737964. Source: OSTI; NTIS; INIS.

Composed of three volumes.

The Office of Civilian Radioactive Waste Management (OCRWM) transportation program is a multifaceted undertaking to transport spent nuclear fuel from commercial reactors to temporary and permanent storage facilities commencing in 1998. One of the significant ingredients necessary to achieving this goal is the development and acquisition of shipping casks. Efforts to design and acquire high capacity casks is ongoing, as are efforts to purchase casks that can be made available using current technology. By designing casks that are optimized to the specifications of the older cooler spent fuel that will be shipped, and by designing to current NRC requirements, OCRWM's new generation of spent fuel casks will be more efficient and at least as safe as current cask designs. (J.P.N.).

27285 (INIS-JP–018, pp. 359-368) **Further experience and developments in the transport of spent fuel.** Gowing, R. (British Nuclear Fuels plc, Risley (United Kingdom)); Purcell, P.C. 1993. 1709p. (CONF-920905–: PATRAM '92: 10th international symposium on the packaging and transportation of radioactive materials, Yokohama (Japan), 13-18 Sep 1992). In *The 10th international symposium on the packaging and transportation of radioactive materials: Proceedings.* Order Number DE94737964. Source: OSTI; NTIS; INIS.

Composed of three volumes.

Transport of spent fuel from Japan started in 1969 with the Magnox fuel from Japan's first nuclear power station. The special features of the flasks used for this are described and experience of their handling summarized. To meet future requirements for the transport of spent LWR fuel of higher burnup and initial enrichment, new flasks are required and progress with the design, licensing and procurement of these is described. (J.P.N.).

27286 (INIS-JP–018, pp. 377-381) **Demonstration test for transporting vitrified high-level radioactive wastes.** Tamaki, H. (Central Research Inst. of Electric Power Industry, Abiko, Chiba (Japan). Abiko Research Lab.); Ito, C.; Ozaki, S.; Shiomi, S. 1993. 1709p. (CONF-920905–: PATRAM '92: 10th international symposium on the packaging and transportation of radioactive materials, Yokohama (Japan), 13-18 Sep 1992). In *The 10th international symposium on the packaging and transportation of radioactive materials: Proceedings.* Order Number DE94737964. Source: OSTI; NTIS; INIS.

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It is the objective of this demonstration test program to ensure safe transport of the vitrified high active wastes resulting from reprocessing plants of COGEMA at La Hague and of BNFL at Sellafield, which will be returned to Japan according to the contracts signed by the reprocessors with Japanese utilities. In this program, transportable casks for vitrified wastes are being designed and fabricated, and subjected to drop tests and thermal tests, etc. to assure that the requirements are satisfied in accordance with the performance and acceptance standards prescribed in the transport regulations for radioactive material. Since design specifications of both type of transportable casks for vitrified wastes being developed by COGEMA and BNFL have not yet been finalized, the demonstration test cask designed combines the COGEMA and BNFL cask with specific structural features of both types. This paper gives a description of the design concept and configuration of this HYBRID-type demonstration test cask, as well as the test plan for normal and accident conditions hereafter. (author).

27287 (INIS-JP–018, pp. 385-392) **Verification tests on cask-storage method for storing spent fuel at reactor.** Saegusa, T. (Central Research Inst. of Electric Power Industry, Tokyo (Japan)); Yamakawa, H.; Mayuzumi, M. 1993. 1709p. (CONF-920905–: PATRAM '92: 10th international symposium on the packaging and transportation of radioactive materials, Yokohama (Japan), 13-18 Sep 1992). In *The 10th international symposium on the packaging and transportation of radioactive materials: Proceedings.* Order Number DE94737964. Source: OSTI; NTIS; INIS.

Composed of three volumes.

CRIEPI has conducted a feasibility study on spent-fuel storage and has shown that shipping and storage casks are the best method for storing less than 500 tons of spent fuel at the reactor. The cask-storage facility is composed of a storage house and

casks. The cask has sealing, heat conduction, shielding and criticality-prevention functions. The storage house is used for managing casks in it. In consideration of the above functions, we confirmed the integrity of cask and spent fuel under normal conditions and in hypothetical accident conditions. (J.P.N.).

27288 (INIS-JP–018, pp. 417-425) **Methods and results of a probabilistic risk assessment for radioactive waste transports.** Lange, F. (Gesellschaft fuer Anlagen- und Reaktorsicherheit (GRS) mbH, Koeln (Germany)); Gruendler, D.; Schwarz, G. 1993. 1709p. (CONF-920905–: PATRAM '92: 10th international symposium on the packaging and transportation of radioactive materials, Yokohama (Japan), 13-18 Sep 1992). In *The 10th international symposium on the packaging and transportation of radioactive materials: Proceedings.* Order Number DE94737964. Source: OSTI; NTIS; INIS.

Composed of three volumes.

The radiological risk from accidents has been analyzed for the expected annual transport volume (3400 shipping units) of low and partially intermediate level radioactive wastes to be shipped to a final repository. In order to take account of these variable quantities and conditions a computer code was developed to simulate a wide spectrum of waste transport and accident configurations using Monte Carlo sampling techniques. Typically some 10.000 source terms were generated to represent possible releases of radionuclides from transport accidents. Accident events in which the integrity of waste packagings is retained and consequently no releases occur are included. Potential radiological consequences are then calculated for each of the release categories by using an accident consequence code which takes into account atmospheric dispersion statistics. Finally cumulative complementary frequency distributions of radiological consequences are generated by superposing the results for all release categories. Radiological consequences are primarily expressed as potential effective individual doses resulting from airborne and deposited radionuclides. The results of the risk analysis show that expected frequencies of effective doses comparable to the natural radiation exposure of one year are quite low and very low for potential radiation exposures in the range of 50 mSv. (J.P.N.).

27289 (INIS-JP–018, pp. 427-433) **Intermodal transfer of spent fuel.** Neuhauser, K.S. (Sandia National Lab., Albuquerque, NM (United States)); Weiner, R.F. 1993. 1709p. (CONF-920905–: PATRAM '92: 10th international symposium on the packaging and transportation of radioactive materials, Yokohama (Japan), 13-18 Sep 1992). In *The 10th international symposium on the packaging and transportation of radioactive materials: Proceedings.* Order Number DE94737964. Source: OSTI; NTIS; INIS.

Composed of three volumes.

This paper discusses RADTRAN calculational models and parameter values for describing dose to workers during incident-free ship-to-truck transfer of spent fuel. Data obtained during observation of the offloading of research reactor spent fuel at Newport News Terminal in the Port of Hampton Roads, Virginia, are described. These data include estimates of exposure times and distances for handlers, inspectors, and other workers during offloading and overnight storage. Other workers include crane operators, scale operators, security personnel, and truck drivers. The data are compared to the default data in RADTRAN 4, and the latter are found to be conservative. The casks were loaded under IAEA supervision at their point of origin, and three separate radiological inspections of each cask were performed at the entry to the port (Hampton Roads) by the U.S. Coast Guard, the state of Virginia, and the shipping firm. As a result of the international standardization of containerized cargo handling in ports around the world, maritime shipment handling is particularly uniform. Thus, handler exposure parameters will be relatively constant for ship-truck and ship-rail transfers at ports throughout the world. Inspectors' doses are expected to vary because of jurisdictional considerations. The results of this study should be applicable to truck-to-rail transfers. (author).

27290 (INIS-JP–018, pp. 434-440) **Total safety assessment for transportation of radioactive wastes.** Watabe, N. (Central Research Inst. of Electric Power Industry, Abiko, Chiba (Japan). Abiko Research Lab.); Ozaki, S.; Itoh, C.; Noguchi, K.; Kinehara, Y.; Suzuki, H.; Satoh, K. 1993. 1709p. (CONF-920905–: PATRAM '92: 10th international symposium on the packaging and transportation of radioactive materials, Yokohama (Japan), 13-18 Sep 1992). In *The 10th international symposium on the packaging and transportation of radioactive materials: Proceedings.* Order Number DE94737964. Source: OSTI; NTIS; INIS.

Composed of three volumes.

CRIEPI has begun to assess the safety of transporting the packages by road or sea and in normal or accident condition. (J.P.N.).

27291 (INIS-JP–018, pp. 1098-1104) **Assessment of the safety of radioactive material transport packages: The French approach to problems relating to the risk of brittle fracture of materials.** Tanguy, L. (CEA Centre d'Etudes de Fontenay-aux-Roses, 92 (France). Inst. de Protection et de Surete Nucleaire); Moulin, D. 1993. 1709p. (CONF-920905–: PATRAM '92: 10th international symposium on the packaging and transportation of radioactive materials, Yokohama (Japan), 13-18 Sep 1992). In *The 10th international symposium on the packaging and transportation of radioactive materials: Proceedings.* Order Number DE94737964. Source: OSTI; NTIS; INIS.

Composed of three volumes.

The recommendations made by the IAEA in 1985 (IAEA Regulations, 1985) require that applicants seeking approval of type B packages must demonstrate that the integrity of the containment of the radioactive materials contained in the transport containers is maintained for the worst conditions liable to be encountered during transport, i.e., accident conditions at an ambient temperature of -40degC. The same applies to the radiological protection. The demonstration concerns the so-called confinement closure walls as well as functional components such seals, covers, stoppers, fasteners, etc... and also the casing containing the radiological protection materials. The purpose of this paper is to present the approach followed by the French Competent Authority in the field of the prevention of brittle fracture risks of the materials used for transport containers, and to communicate the experience gained over the last years from actual applications on various types of containers. (J.P.N.).

27292 (INIS-JP–018, pp. 1621-1627) **The planning and management system of the low level radioactive waste transportation.** Tanaka, K. (Nuclear Fuel Transport Co. Ltd., Tokyo (Japan)); Yoshida, K.; Miyamoto, J.; Sanui, T.; Noura, T.; Kitanishi, K.; Nara, S. 1993. 1709p. (CONF-920905–: PATRAM '92: 10th international symposium on the packaging and transportation of radioactive materials, Yokohama (Japan), 13-18 Sep 1992). In *The 10th international symposium on the packaging and transportation of radioactive materials: Proceedings.* Order Number DE94737964. Source: OSTI; NTIS; INIS.

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Nuclear Fuel Transport Co, Ltd. (hereafter called NFT) was the first in Japan to transport low-level radioactive waste (LLW). It is now engaged in preparatory operations with the slogan 'Improved Safety and Reliability' and is introducing advanced mechanization systems to provide safety and reliability in software management such as transportation planning and transportation information management. The following is an introduction of these systems, which provide overall support in transportation planning determination and transportation management operations related to the LLW transportation cycle. (J.P.N.).

27293 (INIS-JP–018, pp. 1639-1640) **Implementation and operation of a vehicle location system.** Christ, R. (Nuclear Cargo and Service GmbH, Hanau (Germany)); Fay, I.; Jahn, J. 1993. 1709p. (CONF-920905–: PATRAM '92: 10th international symposium on the packaging and transportation of radioactive materials, Yokohama (Japan), 13-18 Sep 1992). In *The 10th international symposium on the packaging and transportation of radioactive materials: Proceedings.* Order Number DE94737964. Source: OSTI; NTIS; INIS.

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NCS operates a security vehicle licensed for the transport of category I nuclear material. Main application is the transport of fresh MOX fuel assemblies to nuclear power plants. For the location sensors two redundant methods were selected: Satellite navigation by 'GPS' (Global Positioning System) and by 'dead reckoning'.

GPS today has outstanding service availability and precision of the location information. Dead reckoning means a system by which the location of the vehicle is calculated from distance and direction with equipment installed in the vehicle. This is done completely independent from the environment and therefore adds to the reliability of the overall system. Data transmission was initially planned to be by HF. Due to problems with the availability of frequencies to be expected in future we switched to cellular radio telephone (in Germany called C-Netz). However the existing network is overloaded and sometimes it is difficult to maintain data transmission. Therefore we will use satellite communication type Inmarsat C in the very near future as soon as the German Inmarsat station will be fully operative. With Inmarsat we will also be in a position to locate the vehicle during international transports. (J.P.N.).

27294 (INIS-JP–018, pp. 1641) **TERM; a transportation emergency response management, resource identification and planning technique.** Cashwell, J.W. (Sandia National Labs., Albuquerque, NM (United States)); List, G.F. 1993. 1709p. (CONF-920905–: PATRAM '92: 10th international symposium on the packaging and transportation of radioactive materials, Yokohama (Japan), 13-18 Sep 1992). In *The 10th international symposium on the packaging and transportation of radioactive materials: Proceedings.* Order Number DE94737964. Source: OSTI; NTIS; INIS.

Composed of three volumes.

Under the sponsorship of the United States Department of Energy (DOE) Office of Environmental Restoration and Waste Management Emergency Preparedness Program, Sandia National Laboratories and Rensselaer Polytechnic Institute developed an emergency planning code to identify existing emergency response resources, estimate response times, and determine deficiencies in the emergency response system. This code, entitled TERM, has been linked to network databases and routing models available on the DOE's TRANSNET system, a centralized dial-up computer system containing routing, risk, and systems analysis codes and associated data. Assessment of emergency response resources and their capabilities and planning for improved capabilities along transportation routes have been identified as areas of concern by states and Indian tribes as well as the Federal Government. The purpose of this project is to develop a computerized technique to assess and plan optimal siting strategies for emergency response resources that can be used by the DOE and state/local governments. This paper will provide an overview of the technique, illustrate its application to the WIPP Program, and discuss integration of the technique into the comprehensive transportation network analysis capabilities available on the TRANSNET system. (J.P.N.).

27295 (INIS-JP–018, pp. 1642) **TRANSNET; access to radioactive and hazardous materials transportation codes and databases.** Cashwell, J.W. (Sandia National Labs., Albuquerque, NM (United States)). 1993. 1709p. (CONF-920905–: PATRAM '92: 10th international symposium on the packaging and transportation of radioactive materials, Yokohama (Japan), 13-18 Sep 1992). In *The 10th international symposium on the packaging and transportation of radioactive materials: Proceedings.* Order Number DE94737964. Source: OSTI; NTIS; INIS.

Composed of three volumes.

Short communication. SERVICE SECTOR/radioactive materials; SERVICE SECTOR/hazardous materials; TRANSPORT; COMPUTER CODES; DATA BASE MANAGEMENT; ON-LINE SYSTEMS; INFORMATION SYSTEMS; USES

27296 (PNL–8806) **Cost update: Technology, safety, and costs of decommissioning reference independent spent fuel storage installations.** Miles, T.L. Pacific Northwest Lab., Richland, WA (United States). Jul 1994. 52p. Sponsored by USDOE, Washington, DC (United States);Nuclear Regulatory Commission, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE94016472. Source: OSTI; NTIS; INIS; GPO Dep.

The cost estimates originally developed in NUREG/CR-2210 for decommissioning five conceptual Independent Spent Fuel Storage Installations (ISFSIs) and their supporting ancillaries (hot cell and transporter) are updated from 1981 to 1993 dollars. The costs for labor and materials increased approximately at the rate of inflation, the cost of energy increased more slowly than the rate of inflation, and the cost of low-level radioactive waste disposal increased much more rapidly than the rate of inflation. A methodology and a formula are presented for estimating the cost of decommissioning the ISFSIs at some future time, based on these current cost estimates. The formula contains essentially the same elements as the formula given in 10 CFR 50.75 for escalating the decommissioning costs for nuclear power reactors to some future time.

27297 (SAND–94-0374C) **Burnup verification tests with the FORK measurement system-implementation for burnup credit.** Ewing, R.I. Sandia National Labs., Albuquerque, NM (United States). [1994]. 7p. Sponsored by USDOE, Washington, DC (United States);Electric Power Research Inst., Palo Alto, CA (United States). DOE Contract AC04-94AL85000. (CONF-940748–51: Institute of Nuclear Materials Management annual meeting, Naples, FL (United States), 17-20 Jul 1994). Order Number DE94016148. Source: OSTI; NTIS; INIS; GPO Dep.

Verification measurements may be used to help ensure nuclear criticality safety when burnup credit is applied to spent fuel transport and storage systems. The FORK system measures the passive neutron and gamma-ray emission from spent fuel assemblies while in the storage pool. It was designed at Los Alamos National Laboratory for the International Atomic Energy Agency safeguards program and is well suited to verify burnup and cooling time records at commercial Pressurized Water Reactor (PWR) sites. This report deals with the application of the FORK system to burnup credit operations.

27298 (SAND–94-0544C) **Development of a transportation planning tool.** Funkhouser, B.R.; Moyer, J.W.; Ballweg, E.L. Sandia National Labs., Albuquerque, NM (United States). [1994]. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. (CONF-940748–5: Institute of Nuclear Materials Management annual meeting, Naples, FL (United States), 17-20 Jul 1994). Order Number DE94015018. Source: OSTI; NTIS; INIS; GPO Dep.

This paper describes the application of simulation modeling and logistics techniques to the development of a planning tool for the Department of Energy (DOE). The focus of the Transportation Planning Model (TPM) tool is to aid DOE and Sandia analysts in the planning of future fleet sizes, driver and support personnel sizes, base site locations, and resource balancing among the base sites. The design approach is to develop a rapid modeling environment which will allow analysts to easily set up a shipment scenario and perform multiple "what if" evaluations. The TPM is being developed on personal computers using commercial off-the shelf (COTS) software tools under the WINDOWS® operating environment. Prototype development of the TPM has been completed.

27299 (SAND–94-1923C) **Comparison of model predictions with measurements using the improved spent fuel attribute tester.** Dupree, S.A. (Sandia National Labs., Albuquerque, NM (United States)); Laub, T.W.; Arlt, R. Sandia National Labs., Albuquerque, NM (United States). [1994]. 5p. Sponsored by Department of State, Washington, DC (United States). DOE Contract AC04-94AL85000. (CONF-940748–25: Institute of Nuclear Materials Management annual meeting, Naples, FL (United States), 17-20 Jul 1994). Order Number DE94015784. Source: OSTI; NTIS; INIS; GPO Dep.

Design improvements for the International Atomic Energy Agency's Spent Fuel Attribute Tester, recommended on the basis of an optimization study, were incorporated into a new instrument fabricated under the Finnish Support Programme. The new instrument was tested at a spent fuel storage pool on September 8 and 9, 1993. The result of two of the measurements have been compared with calculations. In both cases the calculated and measured pulse height spectra in good agreement and the ^{137}Cs gamma peak signature from the target spent fuel element is present.

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Refer also to citation(s) 27272, 27279, 27453, 27456, 27468, 27475, 27476, 27477, 27480, 27483, 27486, 27493, 27498, 27499, 27500, 27505, 27506, 27507, 27511, 27512, 27513, 27520, 27522, 27524, 27528, 27542, 27545, 27546, 27550, 27683, 27756, 27902,

27960, 27963, 27966, 28004, 28014, 28015, 28042, 28303, 28379, 28499, 28503, 28508, 28519, 28881, 28932, 28966

27300 (ANL/CMT/CP–82133) **Applicability of slags as waste forms for hazardous waste.** Bates, J.K. (Argonne National Lab., IL (United States)); Buck, E.C.; Dietz, N.L.; Wronkiewicz, D.J.; Feng, X.; Whitworth, C.; Filius, K.; Battleson, D. Argonne National Lab., IL (United States); MSE, Inc., Butte, MT (United States). [1994]. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38 ; AC22-88ID12735. (CONF-940815–63: International nuclear and hazardous waste management conference, Atlanta, GA (United States), 14-18 Aug 1994). Order Number DE94015030. Source: OSTI; NTIS; INIS; GPO Dep.

Slags, which are a combination of glassy and ceramic phases, were produced by the Component Development and Integration Facility, using a combination of soil and metal feeds. The slags were tested for durability using accelerated test methods in both water vapor and liquid water for time periods up to 179 days. The results indicated that under both conditions there was little reaction of the slag, in terms of material released to solution, or the reaction of the slag to form secondary mineral phases. The durability of the slags tested exceeded that of current high-level nuclear glass formulations and are viable materials, for waste disposal.

27301 (ANL/CMT/CP–82761) **Glassy slag: A complementary waste form to homogeneous glass for the implementation of MAWS in treating DOE low level/mixed wastes.** Feng, X. (Argonne National Lab., IL (United States)); Ordaz, G.; Krumrine, P. Argonne National Lab., IL (United States). [1994]. 12p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-940815–66: International nuclear and hazardous waste management conference, Atlanta, GA (United States), 14-18 Aug 1994). Order Number DE94015032. Source: OSTI; NTIS; INIS; GPO Dep.

Glassy slag waste forms are being developed to complement glass waste forms in implementing the Minimum Additive Waste Stabilization (MAWS) Program for supporting DOE's environmental restoration efforts. These glassy slags are composed of various metal oxide crystalline phases embedded in an alumino-silicate glass phase. The slags are appropriate final waste forms for waste streams that contain large amounts of scrap metals and elements with low solubilities in glass, and that have low-flux contents. Homogeneous glass waste forms are appropriate for wastes with sufficient fluxes and low metal contents. Therefore, utilization of both glass and glassy slag waste forms will make vitrification technology applicable to the treatment of a much larger range of radioactive and mixed wastes. The MAWS approach was a plied to glassy slags by blending multiple waste streams to produce the final waste form, minimizing overall waste form volume and reducing costs. The crystalline oxide phases formed in the glassy slags can be specially formulated so that they are very durable and contain hazardous and radioactive elements in their lattice structures. The Structural Bond Strength (SBS) Model was used to predict the chemical durability of the product from the slag composition so that optimized slag compositions could be obtain with a limited number of crucible melts and testing.

27302 (ANL/CMT/CP–83059) **Technology applications for radioactive waste minimization.** Devgun, J.S. Argonne National Lab., IL (United States). [1994]. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-940815–61: International nuclear and hazardous waste management conference, Atlanta, GA (United States), 14-18 Aug 1994). Order Number DE94015036. Source: OSTI; NTIS; INIS; GPO Dep.

The nuclear power industry has achieved one of the most successful examples of waste minimization. The annual volume of low-level radioactive waste shipped for disposal per reactor has decreased to approximately one-fifth the volume about a decade ago. In addition, the curie content of the total waste shipped for disposal has decreased. This paper will discuss the regulatory drivers and economic factors for waste minimization and describe the application of technologies for achieving waste minimization for low-level radioactive waste with examples from the nuclear power industry.

27303 (ANL/CMT/CP–83184) **Management of radioactive waste from nuclear power plants: An overview.** Devgun, J.S. Argonne National Lab., IL (United States). [1994]. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-940812–14: 29. intersociety energy conversion engineering conference, Monterey, CA (United States), 7-12 Aug 1994). Order Number DE94015035. Source: OSTI; NTIS; INIS; GPO Dep.

The nuclear power industry, which accounts for about 20% of the total electricity supply, is a vital part of the nation's energy resource. While it generates approximately one-third of the commercial low-level radioactive waste produced in the country, it has achieved one of the most successful examples in waste minimization. On the other hand, progress on development of new disposal facilities by the state compacts is currently stalled. The milestones have been repeatedly postponed, and the various Acts passed by Congress on nuclear waste disposal have not accomplished what they were intended to do. With dwindling access to waste disposal sites and with escalating disposal costs, the power plant utilities are forced to store wastes onsite as an interim measure. However, such temporary measures are not a permanent solution. A national will is sorely needed to break out of the current impasse.

27304 (ANL/ET/CP–82151) **Stabilization of low-level mixed waste in chemically bonded phosphate ceramics.** Wagh, A.S. (Argonne National Lab., IL (United States)); Singh, D.; Sarkar, A.V.; Mayberry, J. Argonne National Lab., IL (United States). Jun 1994. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-940815–64: International nuclear and hazardous waste management conference, Atlanta, GA (United States), 14-18 Aug 1994). Order Number DE94015031. Source: OSTI; NTIS; INIS; GPO Dep.

Mixed waste streams, which contain both chemical and radioactive wastes, are one of the important categories of DOE waste streams needing stabilization for final disposal. Recent studies have shown that chemically bonded phosphate ceramics may have the potential for stabilizing these waste streams, particularly those containing volatiles and pyrophorics. Such waste streams cannot be stabilized by conventional thermal treatment methods such as vitrification. Phosphate ceramics may be fabricated at room temperature into durable, hard and dense materials. For this reason room-temperature-setting phosphate ceramic waste forms are being developed to stabilize these to "problem waste streams."

27305 (ANL/EWM/CP–82897) **Engineering management of Underground Storage Tank upgrades and installations.** Patel, P.B. Argonne National Lab., IL (United States). [1994]. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-940853–2: Summer meeting of the American Institute of Chemical Engineers, Denver, CO (United States), 14-17 Aug 1994). Order Number DE94015074. Source: OSTI; NTIS; GPO Dep.

Remediation of Leaking Underground Storage Tanks (LUST) is estimated to cost more than $41 billion in the United States. As of May 1992, 1.5 million Underground Storage Tanks were registered in USA. By September 1992, 184,000 confirmed releases (leaks) were reported in USA. Due to such a vast impact on the environment due to leaking USTS, United States Environmental Protection Agency (USEPA) published final UST regulations in the Federal Register on September 23,1988 (40CFR Part 280) which affected almost every commercial underground storage tank (UST). In a rush to comply with UST regulations, it is important that sufficient attention has been paid to engineering aspects of the work. Due to wide array of UST leak prevention and detection products available, selection of appropriate instrumentation can be time consuming. Most states have taken federal government standards on USTs and incorporated them as state regulations with their state specific modifications depending on their local geological conditions and environmental priorities. However, it is important to find out that state's UST program has been approved by USEPA. This paper consists of discussion of issues based on the author's UST project related experience from current and previous employment. Following are the major UST related regulatory topics discussed in this paper: Specifications;Hiring a contractor; Piping Selection and

Installation; UST Selection and Installation; Leak Detection System Environmental Sampling.

27306 (ANL/EWM/CP–82955) **An innovative approach to solid Low Level Radioactive Waste processing and disposal.** Pancake, D.C. Jr.; Sodaro, M.A. Argonne National Lab., IL (United States). [1994]. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-940815–62: International nuclear and hazardous waste management conference, Atlanta, GA (United States), 14-18 Aug 1994). Order Number DE94015090. Source: OSTI; NTIS; INIS; GPO Dep.

This paper will focus on a new system of Low Level Radioactive Waste (LLW) accumulation, processing and packaging, as-well as the implementation of a Laboratory-wide training program used to introduce new waste accumulation containers to all of the on-site radioactive waste generators, and to train them on the requirements of this innovative waste characterization and documentation program.

27307 (ANL/TD/CP–83100) **Argonne-West Waste Characterization Area for mixed TRU waste.** Duncan, D.S. (Argonne National Lab., Idaho Falls, ID (United States)); Dwight, C.C.; Parks, R.L.; Black, D.B.; Courtney, J.C. Argonne National Lab., IL (United States). [1994]. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-940815–67: International nuclear and hazardous waste management conference, Atlanta, GA (United States), 14-18 Aug 1994). Order Number DE94015062. Source: OSTI; NTIS; INIS; GPO Dep.

Argonne National Laboratory-West has developed characterize and repackage transuranic mixed waste, the Waste Characterization Area (WCA). This new facility is designed to current Department of Energy design criteria for radioactive waste handling facilities Characterization and repackaging of real waste within the WCA began in April 1994. Characterization operations include visual examination of solid waste and drum headspace and inner bag gas sample collection and analysis. Additions planned for the WCA in late 1994 include equipment for sludge waste core sample extraction, preparation, and analysis. This paper addresses general design strategy, facility features, and specialized equipment associated with the WCA.

27308 (ARH–2762) **Input and decayed values of radioactive solid wastes buried in the 200 areas through 1971.** Hanson, G.L.; Anderson, J.D.; Kiel, G.R.; McMurray, B.J.; Nisick, N.P. Atlantic Richfield Hanford Co., Richland, WA (United States). 22 Mar 1973. 29p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE94015232. Source: OSTI; NTIS; GPO Dep.

Solid radioactive wastes resulting from chemical separations processing of spent reactor fuels have been disposed by burial in trenches in the 200 Areas since 1944. Solid radioactive wastes from other Hanford facilities and from off-site AEC contractors have also been buried in the 200 Areas' Waste Burial Grounds. Since 1970, industrial wastes containing or suspected of containing transuranic radionuclides have been packaged in concrete boxes and "dry wastes" have been packaged in steel boxes or drums and buried in segregated trenches. A land area of approximately 149 acres has been used to bury 5.2 million cubic feet of contaminated solid waste through calendar year 1971. Annual reports of radioactive solid waste burials issued, beginning in 1968, have shown land area used, and volume and quantity of radioactivity grams U and/or Pu and curies buried. No corrections for radioactive decay have been reported. In July 1972, J. D. Anderson, G. L. Hanson, G. R. Kiel, B. J. McMurray, and N. P. Nisick were assigned the responsibility for a study to provide the decayed inventory of radioactivity in each solid waste burial ground in the 200 Areas. The results of this study are included as Tables 1 and 2 in this report.

27309 (ARH-CD–371-4Q) **Radioactive liquid wastes discharged to ground in the 200 areas during 1975.** Anderson, J.D. Pacific Northwest Lab., Richland, WA (United States). 1 Apr 1976. 81p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE94016661. Source: OSTI; NTIS; GPO Dep.

This document is issued quarterly for the purpose of summarizing the radioactive liquid wastes that have been discharged to ground in the 200 areas of the Hanford Reservation. In addition to data for 1975, cumulative data since plant startup are presented. Also in this document is a listing of decayed activity to the various plant sites. Data are presented in table form for each individual site and are detailed on a month-to-month basis.

27310 (BfS-ET–18/93) **Radionuclide migration in the caprock above the Gorleben repository: Proceedings.** Hollmann, A. (ed.); Tittel, G. (ed.). Bundesamt fuer Strahlenschutz, Braunschweig (Germany). Fachbereich Nukleare Entsorgung und Transport. Nov 1993. 236p. (In German). (CONF-9206452–: Expert discussion on problems of radionuclide migration and long-term safety of the projected ultimate storage site at Gorleben, Salzgitter (Germany), 3 Jun 1992). Order Number DE94789704. Source: OSTI; NTIS (US Sales Only); INIS.

For the safety analysis of a repository it is required to proof the observance of dose limits pursuant to section 45 Radiation Protection Ordinance in case of possible releases of radionuclides via the water pathway. Therefore, the functioning of barriers of the relevant geological formations must be investigated for various radionuclides by means of sorption and desorption experiments. Since 1981 experiments with sediments and groundwaters from the caprock above the Gorleben saltdome have been carried out on behalf of the Federal Office for Radiation Protection (since 1989) and the Physikalisch-Technische Bundesanstalt (until 1989). An account on the present results was given in an expert talk. (orig.)

27311 (BfS-ET–18/93, pp. 7-9) **Overiew of the complete working programme.** Hollmann, A. (Bundesamt fuer Strahlenschutz, Salzgitter (Germany)). Bundesamt fuer Strahlenschutz, Braunschweig (Germany). Fachbereich Nukleare Entsorgung und Transport. Nov 1993. 236p. (In German). (CONF-9206452–: Expert discussion on problems of radionuclide migration and long-term safety of the projected ultimate storage site at Gorleben, Salzgitter (Germany), 3 Jun 1992). In *Radionuclide migration in the caprock above the Gorleben repository: Proceedings.* Order Number DE94789704. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication GORLEBEN SALT DOME/radionuclide migration; COORDINATED RESEARCH PROGRAMS; GROUND WATER; AQUIFERS; SEDIMENTS; SORPTION

27312 (BfS-ET–18/93, pp. 10-17) **Overview of sediments and ground waters.** Vierhuff, H. (Bundesanstalt fuer Geowissenschaften und Rohstoffe (BGR), Hannover (Germany)). Bundesamt fuer Strahlenschutz, Braunschweig (Germany). Fachbereich Nukleare Entsorgung und Transport. Nov 1993. 236p. (In German). (CONF-9206452–: Expert discussion on problems of radionuclide migration and long-term safety of the projected ultimate storage site at Gorleben, Salzgitter (Germany), 3 Jun 1992). In *Radionuclide migration in the caprock above the Gorleben repository: Proceedings.* Order Number DE94789704. Source: OSTI; NTIS (US Sales Only); INIS.

Together with a sample from the caprock breccia, 15 rock samples were taken from the shafts. Three of them were investigated with two different waters each, so that a total of 18 systems was handled on the basis of these shaft samples. At the Federal Institute for Geosciences and Raw Materials (BGR), the soil-physical and -chemical properties of those samples were investigated (such as pore sizes, porosity, cation exchange capacity). Samples were taken from every major geological bed unit important for potential pollutant propagation, be it in its function as water carrying bed for advective transport or as water retaining bed where diffusion takes place. Important for this were the results of the geohydraulic model calculations carried out so far which had revealed the possible migration pathways. (orig.)

27313 (BfS-ET–18/93, pp. 18-24) **Sampling at the Gorleben shafts 1 and 2 for sorption experiments.** Islinger, C. (DBE, Gorleben (Germany)). Bundesamt fuer Strahlenschutz, Braunschweig (Germany). Fachbereich Nukleare Entsorgung und Transport. Nov 1993. 236p. (In German). (CONF-9206452–: Expert discussion on problems of radionuclide migration and long-term safety of the projected ultimate storage site at Gorleben, Salzgitter (Germany), 3 Jun 1992). In *Radionuclide migration in the caprock above the Gorleben repository: Proceedings.* Order Number DE94789704. Source: OSTI; NTIS (US Sales Only); INIS.

Under the geoscientific investigation programme for the undergound exploration of the Gorleben salt dome, the DBE had been charged by the Federal Office for Radiation Protection (BfS) with the sampling for sorption experiments. The results of these investigations serve to calculate the migration of radionuclides in the caprock in the event of a possible release from the repository. Sampling horizons were determined by the BfS and BGR in all stratigraphic and petrographic units, in order to obtain knowledge as complete as possible about the retention capacity of radionuclides in the caprock, katatectic and saliniferous layers. (orig.)

27314 (BfS-ET–18/93, pp. 25-41) **Sampling and sample preparation of Gorleben groundwaters.** Kunstmann, F. (Deutsche Gesellschaft zum Bau und Betrieb von Endlagern fuer Abfallstoffe mbH, Peine (Germany)). Bundesamt fuer Strahlenschutz, Braunschweig (Germany). Fachbereich Nukleare Entsorgung und Transport. Nov 1993. 236p. (In German). (CONF-9206452–: Expert discussion on problems of radionuclide migration and long-term safety of the projected ultimate storage site at Gorleben, Salzgitter (Germany), 3 Jun 1992). In *Radionuclide migration in the caprock above the Gorleben repository: Proceedings.* Order Number DE94789704. Source: OSTI; NTIS (US Sales Only); INIS.

The stratigraphic sequence of the Quaternary and Tertiary to be found above the Gorleben salt dome and in its environment, forms an acquifer system with a thickness of up to 280 m. Under the Gorleben Hydrogeological Investigation Programme, between 1979 and 1984 more than 320 groundwater measuring points were drilled over an area of about 300 km^2 at the various horizons of the caprock and in the adjacent peripheral sinks of the salt dome, to obtain the completest possible knowledge. In the course of the said programme, hydrochemical field investigations were performed. (orig.)

27315 (BfS-ET–18/93, pp. 42-56) **Analysis and characterization of groundwaters, colloids and sediments in the course of investigations of radionuclide migration in the caprock above the Gorleben salt dome.** Delakowitz, B. (Inst. fuer Radiochemie, Technische Univ. Muenchen (Germany)); Zeh, P.; Kim, J.I. Bundesamt fuer Strahlenschutz, Braunschweig (Germany). Fachbereich Nukleare Entsorgung und Transport. Nov 1993. 236p. (In German). (CONF-9206452–: Expert discussion on problems of radionuclide migration and long-term safety of the projected ultimate storage site at Gorleben, Salzgitter (Germany), 3 Jun 1992). In *Radionuclide migration in the caprock above the Gorleben repository: Proceedings.* Order Number DE94789704. Source: OSTI; NTIS (US Sales Only); INIS.

The development work in the field of colloid research performed at the Institute of Radiochemistry of the Munich Technical University was part of the investigations into radionuclide migration in the caprock of the salt dome of the planned Gorleben repository. About 300 groundwaters from the caprock above the salt dome were exhaustively analysed. By means of modified ultra-filtration methods, colloidal fractions for further characterization were produced in several groundwaters rich in humates. The investigations have shown that humates are laden with metal ions of all valencies. (orig.)

27316 (BfS-ET–18/93, pp. 57-63) **Migration of the radionuclides ^{99}Tc, ^{237}Np, ^{238}Pu and ^{241}Am in the caprock of the Gorleben repository.** Heitz, J. (Inst. fuer Radiochemie, Technische Univ. Muenchen (Germany)); Kim, J.I. Bundesamt fuer Strahlenschutz, Braunschweig (Germany). Fachbereich Nukleare Entsorgung und Transport. Nov 1993. 236p. (In German). (CONF-9206452–: Expert discussion on problems of radionuclide migration and long-term safety of the projected ultimate storage site at Gorleben, Salzgitter (Germany), 3 Jun 1992). In *Radionuclide migration in the caprock above the Gorleben repository: Proceedings.* Order Number DE94789704. Source: OSTI; NTIS (US Sales Only); INIS.

31 different combinations of sediments with groundwaters (sediment-groundwater-systems) formed the basis of the experiments to determine sorption data and sorption mechanisms of radionuclides in selected acquifer systems with loose rock samples taken from shafts 1 and 2. The waters were selected on the basis of pore water analyses. For cohesive materials from which no pore water could be extracted, groundwaters from the horizon below and above were chosen. (orig.)

27317 (BfS-ET–18/93, pp. 64-91) **Dynamic sorption data of selected radionuclides in sediment-water-systems from the Gorleben region.** Klotz, D. (GSF, Inst. fuer Hydrologie, Neuherberg (Germany)). Bundesamt fuer Strahlenschutz, Braunschweig (Germany). Fachbereich Nukleare Entsorgung und Transport. Nov 1993. 236p. (In German). (CONF-9206452–: Expert discussion on problems of radionuclide migration and long-term safety of the projected ultimate storage site at Gorleben, Salzgitter (Germany), 3 Jun 1992). In *Radionuclide migration in the caprock above the Gorleben repository: Proceedings.* Order Number DE94789704. Source: OSTI; NTIS (US Sales Only); INIS.

In 48 sediment-water-systems from the Gorleben region about 300 continuous-flow-column experiments were performed with 10 radionuclides. To simulate conditions as close as possible to natural ones (as regards the bedding of sediments, speed of filtration, environment, and microbiology - if necessary) for the sediment-groundwater-systems, the ranges of retardation factors for fresh, mixed and salt water systems were specified. For the investigated sand-water-systems, a comparison of the results obtained from continuous-flow-column and batch experiments for 85Sr and 134Cs was made. (orig.)

27318 (BfS-ET–18/93, pp. 92-103) **Determination of experimental data by batch experiments to estimate the migration retardation of radioactive fission and activation products.** Lang, H. (GSF, Inst. fuer Hydrologie, Neuherberg (Germany)); Wolfrum, C. Bundesamt fuer Strahlenschutz, Braunschweig (Germany). Fachbereich Nukleare Entsorgung und Transport. Nov 1993. 236p. (In German). (CONF-9206452–: Expert discussion on problems of radionuclide migration and long-term safety of the projected ultimate storage site at Gorleben, Salzgitter (Germany), 3 Jun 1992). In *Radionuclide migration in the caprock above the Gorleben repository: Proceedings.* Order Number DE94789704. Source: OSTI; NTIS (US Sales Only); INIS.

Sorption and desorption equilibriums of radionuclides of the elements Sr^{2+}, Cs^{+}, Co^{2+} and I^{-} determined in batch experiments with natural samples, in general show considerable dependences on the experimental and chemical boundary conditions. By applying exponential isotherms it can be demonstrated that such dependences ultimately can be reduced to the influence of radionuclide concentration. If, in addition, the concurrent influence of other ions existing in the groundwater is taken into account, it can be concluded that the sorption of these radionuclides is conditioned by isotope or ion exchange. (orig.)

27319 (BfS-ET–18/93, pp. 104-142) **Results of sorption experiments with sediment-groundwater-systems taking into account parameter variations.** Meier, H. (Staatliches Forschungsinstitut fuer Geochemie, Bamberg (Germany)); Zimmerhackl, E.; Zeitler, G.; Menge, P. Bundesamt fuer Strahlenschutz, Braunschweig (Germany). Fachbereich Nukleare Entsorgung und Transport. Nov 1993. 236p. (In German). (CONF-9206452–: Expert discussion on problems of radionuclide migration and long-term safety of the projected ultimate storage site at Gorleben, Salzgitter (Germany), 3 Jun 1992). In *Radionuclide migration in the caprock above the Gorleben repository: Proceedings.* Order Number DE94789704. Source: OSTI; NTIS (US Sales Only); INIS.

The sorption and desorption data of the radionuclides uranium, thorium, radium, actinium, lead, nickel, polonium and bismuth measured at site-specific sandy and cohesive sediment samples are discussed. The influence of various parameters on the sorption behaviour of nuclides is also discussed. Moreover, the loadability of the sorption data is demonstrated by means of the models prepared to describe or explain parameter influences. (orig./DG)

27320 (BfS-ET–18/93, pp. 143-165) **Hydraulic investigations of sediment-water-systems from the Gorleben region.** Klotz, D. (GSF, Inst. fuer Hydrologie, Neuherberg (Germany)). Bundesamt fuer Strahlenschutz, Braunschweig (Germany). Fachbereich Nukleare Entsorgung und Transport. Nov 1993. 236p. (In German). (CONF-9206452–: Expert discussion on problems of radionuclide migration and long-term safety of the projected ultimate storage site at Gorleben, Salzgitter (Germany), 3 Jun 1992). In *Radionuclide migration in the caprock above the Gorleben repository: Proceedings.* Order Number DE94789704. Source: OSTI; NTIS (US Sales Only); INIS.

Radionuclide migration in sediment-water-systems is determined, in addition to the sorption of the radionuclide, by the physical interactions of the flowing groundwater and granular skeleton of the sediment, which are called the hydraulic properties of the system sediment/water. Hydraulic properties of the system sediment/water which are important for pollutant migration are its permeability, effective porosity, and hydrodynamic dispersion. The results of the hydraulic investigations of sediment-water-systems from the Gorleben region are summarized. (orig./DG)

27321 (BfS-ET–18/93, pp. 166-204) **Microbiological investigation of soil samples of the caprock above the Gorleben salt dome.** Kutzner, H.J. (Technische Hochschule Darmstadt (Germany). Inst. fuer Mikrobiologie); Sonnen, H.; Bachmann, F. Bundesamt fuer Strahlenschutz, Braunschweig (Germany). Fachbereich Nukleare Entsorgung und Transport. Nov 1993. 236p. (In German). (CONF-9206452–: Expert discussion on problems of radionuclide migration and long-term safety of the projected ultimate storage site at Gorleben, Salzgitter (Germany), 3 Jun 1992). In *Radionuclide migration in the caprock above the Gorleben repository: Proceedings.* Order Number DE94789704. Source: OSTI; NTIS (US Sales Only); INIS.

Microorganisms constitute an essential part of the soil structure. Through their activities a large number of processes in the soil are caused: decomposition (mineralization) and conversion (humate formation) of organic substances; formation of biomass (reproduction); oxidation and reduction of various elements or compounds, and thus generation of a geomicrobiological cycle of nitrogen, sulphur, iron, manganese and other elements; and, at the same time, by means of oxidation/reduction processes they cause modifications of the solubility of metals (precipitation or mobility increase). Therefore, an influence exerted by microorganisms, as an integral part of the caprock, on radionuclide migration cannot be excluded. The investigations performed served to look into the question to which extent microorganisms occur in the profile of the caprock above the Gorleben salt dome; which geomicrobiological activities are to be expected there due to their physiological properties, and whether their influence on radionuclide migration seems to be realistic. (orig./DG)

27322 (BfS-ET–18/93, pp. 205-225) **Influence of natural colloids on radionuclide migration in the caprock above the Gorleben salt dome.** Kim, J.I. (Inst. fuer Radiochemie, Technische Univ. Muenchen (Germany)); Delakowitz, B.; Zeh, P. Bundesamt fuer Strahlenschutz, Braunschweig (Germany). Fachbereich Nukleare Entsorgung und Transport. Nov 1993. 236p. (In German). (CONF-9206452–: Expert discussion on problems of radionuclide migration and long-term safety of the projected ultimate storage site at Gorleben, Salzgitter (Germany), 3 Jun 1992). In *Radionuclide migration in the caprock above the Gorleben repository: Proceedings.* Order Number DE94789704. Source: OSTI; NTIS (US Sales Only); INIS.

The paper deals with the chemical interaction of radionuclides with groundwater colloids in selected Gorleben acquifers. Since colloids have different transport properties compared with dissolved metal ions, the interaction of radionuclides with groundwater colloids has a decisive influence on migration, and is therefore of fundamental importance for long-term safety analyses. Selected groundwaters were conditioned by trace concentrations of the actinides Am, Cm, Th and Np. Thus the colloidal influence on the trivalent, quadrivalent and, pentavalent actinides could be studied. For hexavalent actinides the analytical data of uranium of natural occurrence in groundwaters were used. (orig.)

27323 (BfS-ET–18/93, pp. 226-229) **Approaches to the use of bench-scale experimental data on radionuclide retention in long-term safety analyses.** Zude, F.; Kuehle, T. Bundesamt fuer Strahlenschutz, Braunschweig (Germany). Fachbereich Nukleare Entsorgung und Transport. Nov 1993. 236p. (In German). (CONF-9206452–: Expert discussion on problems of radionuclide migration and long-term safety of the projected ultimate storage site at Gorleben, Salzgitter (Germany), 3 Jun 1992). In *Radionuclide migration in the caprock above the Gorleben repository: Proceedings.* Order Number DE94789704. Source: OSTI; NTIS (US Sales Only); INIS.

In order to be able to perform a long-term safety analysis on a reliable basis, reduce hyperconservatisms, and obtain loadable results, a mechanistic understanding of the essential effects connected with a description on a thermodynamic basis is a precondition. The BfS, too, recognizes the necessity of theoretical corroboration of empirical data. The project management of the skeleton plan, by means of a stategy paper on geochemical modelling, has pointed out a way how to achieve a reliable retention modelling which takes into consideration the relevant geochemical effects. (orig./DG)

27324 (BNL–49737) **Enumeration and characterization of microorganisms associated with the uranium ore deposit at Cigar Lake, Canada: Informal report.** Francis, A.J.; Joshi-Tope, G.; Gillow, J.B.; Dodge, C.J. Brookhaven National Lab., Upton, NY (United States). Mar 1994. 42p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH00016. Order Number DE94016231. Source: OSTI; NTIS; INIS; GPO Dep.

The high-grade uranium deposit at Cigar Lake, Canada, is being investigated as a natural analog for the disposal of nuclear fuel waste. Geochemical aspects of the site have been studied in detail, but the microbial ecology has not been fully investigated. Microbial populations in an ore sample and in groundwater samples from the vicinity of the ore zone were examined to determine their effect on uranium mobility. Counts of the total number of bacteria and of respiring bacteria were obtained by direct microscopy, and the viable aerobic and anaerobic bacteria were assessed as colony forming units (CFUs) by the dilution plating technique. In addition, the population distribution of denitrifiers, fermenters, iron- and sulfur-oxidizers, iron- and sulfate-reducers, and methanogens was determined by the most probable number (MPN) technique.

27325 (BNL–60503) **Biochemical processing of geothermal brines and sludges: Adaptability to multiple industrial applications.** Premuzic, E.T.; Lin, M.S.; Jin, J.Z. Brookhaven National Lab., Upton, NY (United States). [1994]. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH00016. (CONF-941043–3: Annual meeting of the Geothermal Resources Council, Salt Lake City, UT (United States), 3-5 Oct 1994). Order Number DE94014976. Source: OSTI; NTIS; GPO Dep.

Extensive Research and Development effort leading to the identification of low cost environmentally acceptable disposal of geothermal brines and sludges has shown that biochemical processing of the waste streams meets these requirements. Further exploration of the process variables has also indicated that biochemical treatment of waste streams is a versatile technology, adaptable to several applications beyond that of rendering hazardous and/or mixed wastes to nonhazardous byproducts which meet regulatory requirements. Such advanced biochemical technologies may be used for solubilization and recovery of a few metals such as arsenic and mercury to the isolation of many metals, including radionuclides. Spin-offs from this technology have also applications in the treatment of crude oils, oil wastes and the recovery of valuable metals and salts. In the metal recovery mode the aqueous phase can be reinjected or treated further so that the end products meet the environmental drinking water standards. In this paper, recent studies dealing with the multiple industrial applications potential of biochemical processes will be discussed.

27326 (CONF-9309228–11) **Three-dimensional lithostratigraphic model at Yucca Mountain, Nevada: A framework for fluid transport modeling and engineering design.** Buesch, D.C. (Geological Survey, Las Vegas, NV (United States)); Spengler, R.W.; Nelson, J.E.; Dickerson, R.P. Geological Survey, Las Vegas, NV (United States). [1993]. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AI08-92NV10874. From Focus 93: site characterization and model validation; Las Vegas, NV (United States); 26-29 Sep 1993. Order Number DE94014850. Source: OSTI; NTIS; INIS; GPO Dep.

A three-dimensional lithostratigraphic model of the central block of Yucca MounEain. Nevada, illustrates how some activities can serve both site characterization and dcsign and construction of the Exploratory Studies Facility (ESF). Site-characterization activities supported bv this model include characterizing the three-dimensional geometry of lithologic units and faults, and providing boundary conditions for geostatistical models and site-scale fluid

flow modeling. The model supports the conceptual design as construction efforts for the proposed ramps of the ESF and potential high-level nuclear waste repository.

27327 (CONF-940553–40) **Voluntary vs directed siting – or somewhere in-between?.** Peelle, E.B. Oak Ridge National Lab., TN (United States). [1994]. 13p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From International high-level radioactive waste management conference; Las Vegas, NV (United States); 22-26 May 1994. Order Number DE94010122. Source: OSTI; NTIS; GPO Dep.

Waste siting gridlock in the United States and Canada has led to experimentation with voluntary and hybrid or "mixed mode" siting. We review nuclear and hazardous waste voluntary siting (VS) results for selected cases in the U.S, and Canada. Findings indicate that VS is not a panacea, but that current siting efforts are inadequate tests of its potential. We suggest trials of improved VS protocols and more effort on hybrid approaches in which the developer chooses the site but is required to reach agreement on conditions with local stakeholders. Mixed mode siting may be better suited to the US context and its three-tiered governmental system.

27328 (CONF-940815–44) **Regulatory facility guides for the transportation of hazardous and other materials.** Anderson, S.S.; Francis, M.W.; Gove, R.M. Oak Ridge National Lab., TN (United States). [1994]. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From International nuclear and hazardous waste management conference; Atlanta, GA (United States); 14-18 Aug 1994. Order Number DE94014103. Source: OSTI; NTIS; INIS; GPO Dep.

Regulatory Facility Guides (RFGS) are being developed to provide the US. Department of Energy (DOE) and DOE contractor facilities with the understanding of the exact applicability of specific transportation regulations to DOE shippers. These detailed state-specific compilations of federal, state, tribal, local, and international transportation regulations should lead to enhanced compliance, fewer efforts, and less confusion. To date, RFGs for three states have been developed. The RFGs for Tennessee and Ohio were finalized in February 1994 and have been distributed under a controlled distribution. The RFG for New Meidco is in final draft form and is undergoing DOE review. Two additional RFGs, for the states of Idaho and California, are expected to be completed by September 1994.

27329 (CONF-9408110–1) **Groundwater modeling of source terms and contaminant plumes for DOE low-level waste performance assessments.** McDowell-Boyer, L.M.; Wilson, J.E. Oak Ridge National Lab., Grand Junction, CO (United States). [1994]. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From 1994 groundwater modeling conference; Fort Collins, CO (United States); 10-13 Aug 1994. Order Number DE94014019. Source: OSTI; NTIS; INIS; GPO Dep.

Under US Department of Energy (DOE) Order 5820.2A, all sites within the DOE complex must analyze the performance of planned radioactive waste disposal facilities before disposal takes place through the radiological performance assessment process. These assessments consider both exposures to the public from radionuclides potentially released from disposal facilities and protection of groundwater resources. Compliance with requirements for groundwater protection is often the most difficult to demonstrate as these requirements are generally more restrictive than those for other pathways. Modeling of subsurface unsaturated and saturated flow and transport was conducted for two such assessments for the Savannah River site. The computer code PORFLOW was used to evaluate release and transport of radionuclides from different types of disposal unit configurations: vault disposal and trench disposal. The effectiveness of engineered barriers was evaluated in terms of compliance with groundwater protection requirements. The findings suggest that, due to the limited lifetime of engineered barriers, overdesign of facilities for long-lived radionuclides is likely to occur if compliance must be realized for thousands of years.

27330 (DOE/EA–0851) **Environmental assessment for the recycling of slightly activated copper coil windings from the 184-Inch Cyclotron at Lawrence Berkeley Laboratory, Berkeley, California.** USDOE, Washington, DC (United States). 2 Aug 1993. 58p. Sponsored by USDOE, Washington, DC (United States). Order Number DE94015404. Source: OSTI; NTIS; GPO Dep.

The proposed action is to recycle slightly activated copper that is currently stored in a warehouse leased by Lawrence Berkeley Laboratory (LBL) to a scrap metal dealer. Subsequent reutilization of the copper would be unrestricted. This document addresses the potential environmental effects of recycling and reutilizing the activated copper. In addition, the potential environmental effects of possible future uses by the dealer are addressed. Direct environmental effects from the proposed action are assessed, such as air emissions from reprocessing the activated copper, as well as indirect beneficial effects, such as averting air emissions that would result from mining and smelting an equivalent quantity of copper ore. Evaluation of the human health impacts of the proposed action focuses on the pertinent issues of radiological doses and protection of workers and the public. Five alternatives to the proposed action are considered, and their associated potential impacts are addressed. The no-action alternative is the continued storage of the activated copper at the LBL warehouse. Two recycling alternatives are considered: recycling the activated copper at the Scientific Ecology Group (SEG) facility for re-use at a DOE facility and selling or giving the activated copper to a foreign government. In addition, two disposal alternatives evaluate the impacts attributable to disposing of the activated copper either at a local sanitary landfill or at the Hanford Low-Level Waste Burial Site. The proposed project and alternatives include no new construction or development of new industry.

27331 (DOE/EM–0177-Vol.2) **High-level waste borosilicate glass: A compendium of corrosion characteristics: Volume 2.** Cunnane, J.C. (comp.) (Argonne National Lab., IL (United States)); Bates, J.K.; Bradley, C.R. USDOE Assistant Secretary for Environmental Management, Washington, DC (United States). High-Level Waste Div. Mar 1994. 350p. Sponsored by USDOE, Washington, DC (United States). Order Number DE94016637. Source: OSTI; NTIS; INIS; GPO Dep.

The objective of this document is to summarize scientific information pertinent to evaluating the extent to which high-level waste borosilicate glass corrosion and the associated radionuclide release processes are understood for the range of environmental conditions to which waste glass may be exposed in service. Alteration processes occurring within the bulk of the glass (e.g., devitrification and radiation-induced changes) are discussed insofar as they affect glass corrosion.This document is organized into three volumes. Volumes I and II represent a tiered set of information intended for somewhat different audiences. Volume I is intended to provide an overview of waste glass corrosion, and Volume 11 is intended to provide additional experimental details on experimental factors that influence waste glass corrosion. Volume III contains a bibliography of glass corrosion studies, including studies that are not cited in Volumes I and II. Volume I is intended for managers, decision makers, and modelers, the combined set of Volumes I, II, and III is intended for scientists and engineers working in the field of high-level waste.

27332 (DOE/EM–0177-Vol.3) **High-level waste borosilicate glass: A compendium of corrosion characteristics: Volume 3.** Cunnane, J.C. (comp.) (Argonne National Lab., IL (United States)); Bates, J.K.; Bradley, C.R. USDOE Assistant Secretary for Environmental Management, Washington, DC (United States). High-Level Waste Div. Mar 1994. 182p. Sponsored by USDOE, Washington, DC (United States). Order Number DE94016638. Source: OSTI; NTIS; INIS; GPO Dep.

The objective of this document is to summarize scientific information pertinent to evaluating the extent to which high-level waste borosilicate glass corrosion and the associated radionuclide release processes are understood for the range of environmental conditions to which waste glass may be exposed in service. Alteration processes occurring within the bulk of the glass (e.g., devitrification and radiation-induced changes) are discussed insofar as they affect glass corrosion. Volume III contains a bibliography of glass corrosion studies, including studies that are not cited in Volumes I and II.

27333 (DOE/ID–10453-Pt.1) **Idaho National Engineering Laboratory Conceptual Site Treatment Plan: Sections 1**

through 8, Tables 2-1 through 6-1, Figures 1 and 2. Eaton, D. USDOE Idaho Field Office, Idaho Falls, ID (United States). Oct 1993. 242p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE94015238. Source: OSTI; NTIS; INIS; GPO Dep.

The US Department of Energy (DOE) is required by Section 3021(b) of the Resource Conservation and Recovery Act (RCRA), as amended by the Federal Facility Compliance Act (FFCAct), to prepare plans describing the development of treatment capacities and technologies for treating mixed waste. The FFCAct requires site treatment plans (STPs or plans) to be developed for each site at which DOE generates or stores mixed waste and submitted to the host state or the US Environmental Protection Agency (EPA) for either approval, approval with modification, or disapproval. The Idaho National Engineering Laboratory (INEL) Conceptual Site Treatment Plan (CSTP) is the preliminary version of the plan required by the FFCAct and is being provided to the State of Idaho, the EPA, and others for review. A list of the other DOE sites preparing CSTPs is included in Appendix A of this document. In addition to aiding the INEL in formulating its Final Proposed STP, this CSTP will also provide information to other DOE sites for use in identifying common technology needs and potential options for treating their wastes. The INEL CSTP is also intended to be used in conjunction with CSTPs from other sites as a basis for nationwide discussions among state regulators, the EPA, and other interested parties on treatment strategies and options, and on technical and equity issues associated with DOE's mixed waste.

27334 (DOE/ID–10453-Pt.2) **Idaho National Engineering Laboratory Conceptual Site Treatment Plan: Tables 8.1 and 8.2, Appendices A, B, C.** Eaton, D. EG and G Idaho, Inc., Idaho Falls, ID (United States). Oct 1993. 684p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE94015239. Source: OSTI; NTIS; INIS; GPO Dep.

The US Department of Energy (DOE) is required by Section 3021(b) of the Resource Conservation and Recovery Act (RCRA), as amended by the Federal Facility Compliance Act (FFCAct), to prepare plans describing the development of treatment capacities and technologies for treating mixed waste. The FFCAct requires site treatment plans (STPs or plans) to be developed for each site at which DOE generates or stores mixed waste and submitted to the host state or the US Environmental Protection Agency (EPA) for either approval, approval with modification, or disapproval. The Idaho National Engineering Laboratory (INEL) Conceptual Site Treatment Plan (CSTP) is the preliminary version of the plan required by the FFCAct and is being provided to the State of Idaho, the EPA, and others for review. A list of the other DOE sites preparing CSTPs is included in Appendix A of this document. In addition to aiding the INEL in formulating its Final Proposed STP, this CSTP will also provide information to other DOE sites for use in identifying common technology needs and potential options for treating their wastes. The INEL CSTP is also intended to be used in conjunction with CSTPs from other sites as a basis for nationwide discussions among state regulators, the EPA, and other interested parties on treatment strategies and options, and on technical and equity issues associated with DOE's mixed waste.

27335 (DOE/MC/30171–94/C0344) **Quantum-catalytic extraction process application to mixed waste processing.** Herbst, C.A. (Molten Metal Technology, Fall River, MA (United States)); Loewen, E.P.; Nagel, C.J.; Protopapas, A. Molten Metals Technology, Inc., Waltham, MA (United States). [1994]. 7p. Sponsored by USDOE, Washington, DC (United States);American Nuclear Society, La Grange Park, IL (United States);Japan Atomic Energy Research Inst., Tokyo (Japan);International Atomic Energy Agency, Vienna (Austria). DOE Contract AC21-93MC30171. (CONF-940815–59: International nuclear and hazardous waste management conference, Atlanta, GA (United States), 14-18 Aug 1994). Order Number DE94014873. Source: OSTI; NTIS; INIS; GPO Dep.

The Catalytic Extraction Process (CEP) is a flexible and innovative technology which can process hazardous waste streams in a wide range of chemical and physical forms. The capabilities of CEP technology have been demonstrated on a commercial-scale prototype on RCRA listed hazardous waste streams. The results indicate that CEP can achieve almost 100% recycling of feed to commercially valuable products while maintaining high environmental performance. Specifically, CEP achieves Destruction Removal Efficiencies (DREs) $\geq$ 99.9999% with no detectable amounts of trace components. Furthermore, any solid products are non-leachable. Quantum-CEP™, a technology that has evolved from CEP, allows processing of mixed waste streams and preparation for final form disposal. This paper discusses the theoretically achievable and experimentally demonstrated radionuclide partitioning achieved by Quantum-CEP. It also discusses the theoretical foundations and experimental evidence of Quantum-CEP's flexibility to drive partitioning to the desired phase by manipulating operating conditions, hence significantly improving volume reduction. Specifically, this paper focuses on (i) processing contaminated scrap metal and (ii) processing contaminated ion exchange resins using Quantum-CEP. Radionuclide surrogate demonstrations using CEP outlined in this paper indicate decontamination of metal to greater that 99% (limited by the lower detection limit (LDL)) while achieving stabilization of the vitreous phase. Processing of ion exchange resins contaminated with radioactive cobalt and cesium using CEP indicate complete recovery and concentration of the cobalt in the metal phase and condensation and capture of the cesium from the gaseous phase.

27336 (DOE/MWIP–20) **Treatment technology analysis for mixed waste containers and debris.** Gehrke, R.J. (Idaho National Engineering Lab., Idaho Falls, ID (United States)); Brown, C.H.; Langton, C.A.; Askew, N.M.; Kan, T.; Schwinkendorf, W.E. Oak Ridge National Lab., TN (United States). Mar 1994. 50p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. (ORNL/M–3609). Order Number DE94015451. Source: OSTI; NTIS; INIS; GPO Dep.

A team was assembled to develop technology needs and strategies for treatment of mixed waste debris and empty containers in the Department of Energy (DOE) complex, and to determine the advantages and disadvantages of applying the Debris and Empty Container Rules to these wastes. These rules issued by the Environmental Protection Agency (EPA) apply only to the hazardous component of mixed debris. Hazardous debris that is subjected to regulations under the Atomic Energy Act because of its radioactivity (i.e., mixed debris) is also subject to the debris treatment standards. The issue of treating debris per the Resource Conservation and Recovery Act (RCRA) at the same time or in conjunction with decontamination of the radioactive contamination was also addressed. Resolution of this issue requires policy development by DOE Headquarters of de minimis concentrations for radioactivity and release of material to Subtitle D landfills or into the commercial sector. The task team recommends that, since alternate treatment technologies (for the hazardous component) are Best Demonstrated Available Technology (BDAT): (1) funding should focus on demonstration, testing, and evaluation of BDAT on mixed debris, (2) funding should also consider verification of alternative treatments for the decontamination of radioactive debris, and (3) DOE should establish criteria for the recycle/reuse or disposal of treated and decontaminated mixed debris as municipal waste.

27337 (DOE/MWIP–29) **Mixed Waste Integrated Program Quality Assurance requirements plan.** Oak Ridge National Lab., TN (United States). 15 Apr 1994. 56p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. (ORNL/M–3691). Order Number DE94015425. Source: OSTI; NTIS; INIS; GPO Dep.

Mixed Waste Integrated Program (MWIP) is sponsored by the US Department of Energy (DOE), Office of Technology Development, Waste Management Division. The strategic objectives of MWIP are defined in the Mixed Waste Integrated Program Strategic Plan, and expanded upon in the MWIP Program Management Plan. This MWIP Quality Assurance Requirement Plan (QARP) applies to mixed waste treatment technologies involving both hazardous and radioactive constituents. As a DOE organization, MWIP is required to develop, implement, and maintain a written Quality Assurance Program in accordance with DOE Order 4700.1 Project Management System, DOE Order 5700.6C, Quality Assurance, DOE Order 5820.2A Radioactive Waste Management, ASME NQA-1 Quality Assurance Program Requirements for Nuclear Facilities

and ANSI/ASQC E4-19xx Specifications and Guidelines for Quality Systems for Environmental Data Collection and Environmental Technology Programs. The purpose of the MWIP QA program is to establish controls which address the requirements in 5700.6C, with the intent to minimize risks and potential environmental impacts; and to maximize environmental protection, health, safety, reliability, and performance in all program activities. QA program controls are established to assure that each participating organization conducts its activities in a manner consistent with risks posed by those activities.

27338 (DOE/NV–373) **Trench sampling report Salmon Site Lamar County, Mississippi.** International Technology, Inc., Las Vegas, NV (United States). Jul 1994. 248p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC08-92NV10972. Order Number DE94015593. Source: OSTI; NTIS; INIS; GPO Dep.

This report describes trench excavation and sample-collection activities conducted by IT Corporation (IT) as part of the ongoing Remedial Investigation and Feasibility Study at the Salmon Site, Lamar County, Mississippi (DOE, 1992). During construction, operation, and closure of the site wastes of unknown composition were buried in pits on site. Surface-geophysical field investigations were conducted intermittently between November 1992 and October 1993 to identify potential waste-burial sites and buried metallic materials. The geophysical investigations included vertical magnetic gradient, electromagnetic conductivity, electromagnetic in-phase component, and ground-penetrating radar surveys. A number of anomalies identified by the magnetic gradiometer survey in the Reynolds Electrical & Engineering Co., Inc., (REECo) pits area indicated buried metallic objects. All of the anomalies were field checked to determine if any were caused by surface features or debris. After field checking, 17 anomalies were still unexplained; trenching was planned to attempt to identify their sources. Between December 8, 1993, and December 17, 1993, 15 trenches were excavated and soil samples were collected at the anomalies. Samples were collected, placed in 250- and 500-milliliter (m*l*) amber glass containers, and shipped on ice to IT Analytical Services (ITAS) in St. Louis, Missouri, using standard IT chain-of-custody procedures. The samples were analyzed for various chemical and radiological parameters. Data validation has not been conducted on any of the samples. During excavation and sampling, soil samples were also collected by IT for the MSDEQ and the Mississippi Department of Radiological Health, in accordance with their instructions, and delivered into their custody.

27339 (DOE/RL–93-79) **Limited field investigation report for the 100-KR-4 Operable Unit.** USDOE Richland Operations Office, WA (United States). Jul 1994. 94p. Sponsored by USDOE, Washington, DC (United States). Order Number DE94015648. Source: OSTI; NTIS; INIS; GPO Dep.

This limited field investigation (LFI) was conducted to optimize the use of interim remedial measures (IRM) for expediting clean up while maintaining a technically sound and cost-effective program. The 100-KR-4 Operable Unit is one of four operable units associated with the 100 K Area. Operable units KR-1, KR-2 and KR-3 address contaminant sources while 100-KR-4 addresses contamination present in the underlying groundwater. The IRM decision process for groundwater operable units is based on three aspects: (1) Is the concentration greater than Hanford background? (2) Does the concentration present a medium or high human-health risk? (3) Does the concentration exceed an ecologically based applicable, relevant and appropriate requirements (ARAR) or present an environmental hazard quotient > I? The primary methods of investigation used during this LFI were the installation of monitoring wells and sampling of groundwater. The samples collected from the groundwater and soils were submitted for laboratory analysis. Boreholes were surveyed for radiological contamination using downhole geophysical techniques to further delineate the location and degree of contamination. All soil samples were screened to ascertain the presence of volatile organic compounds and radionuclides. Analytical data were subjected to validation; all first round and a minimum of 10% of subsequent round data were validated.

27340 (DOE/RL–93-99) **Remedial investigation and feasibility study report for the Environmental Restoration Disposal Facility.** Roeck, F.V. USDOE Richland Operations Office, WA (United States). Jun 1994. 630p. Sponsored by USDOE, Washington, DC (United States). Order Number DE94015713. Source: OSTI; NTIS; INIS; GPO Dep.

The purpose of the remedial investigation (RI) is to collect data necessary to adequately characterize the site for the purpose of developing and evaluating effective remedial alternatives. To characterize the site, the lead agency shall, as appropriate, conduct field investigations, including treatability studies, and conduct a baseline risk assessment. The RI provides information to assess the risks to human health and the environment and to support the development, evaluation, and selection of appropriate response alternatives. The primary objective of the feasibility study (FS) is to ensure that appropriate remedial alternatives are developed and evaluated such that relevant information concerning the remedial action options can be presented to a decision-maker and an appropriate remedy selected. The lead agency may develop a feasibility study to address a specific site problem or the entire site. The development and evaluation of alternatives shall reflect the scope and complexity of the remedial action under consideration and the site problems being addressed. Development of alternatives shall be fully integrated with the site characterization activities of the remedial investigation described in paragraph (d) of this section. The lead agency shall include an alternatives screening step, when needed, to select a reasonable number of alternatives for detailed analysis.

27341 (DOE/RL–94-22) **State Waste Discharge Permit application, 100-N Sewage Lagoon.** USDOE Richland Operations Office, WA (United States). Jun 1994. 106p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE94016323. Source: OSTI; NTIS; INIS; GPO Dep.

As part of the Hanford Federal Facility Agreement and Consent Order negotiations (Ecology et al. 1994), the US Department of Energy, Richland Operations Office, the US Environmental Protection Agency, and the Washington State Department of Ecology agreed that liquid effluent discharges to the ground on the Hanford Site which affect groundwater or have the potential to affect groundwater would be subject to permitting under the structure of Chapter 173–216 (or 173–218 where applicable) of the Washington Administrative Code, the State Waste Discharge Permit Program. As a result of this decision, the Washington State Department of Ecology and the US Department of Energy, Richland Operations Office entered into Consent Order No. DE 91NM-177, (Ecology and DOE-RL 1991). This document constitutes the State Waste Discharge Permit application for the 100-N Sewage Lagoon. Since the influent to the sewer lagoon is domestic waste water, the State Waste Discharge Permit application for Public Owned Treatment Works Discharges to Land was used. Although the 100-N Sewage Lagoon is not a Public Owned Treatment Works, the Public Owned Treatment Works application is more applicable than the application for industrial waste water. The 100-N Sewage Lagoon serves the 100-N Area and other Hanford Site areas by receiving domestic waste from two sources. A network of sanitary sewer piping and lift stations transfers domestic waste water from the 100-N Area buildings directly to the 100-N Sewage Lagoon. Waste is also received by trucks that transport domestic waste pumped from on site septic tanks and holding tanks. Three ponds comprise the 100-N Sewage Lagoon treatment system. These include a lined aeration pond and stabilization pond, as well as an unlined infiltration pond. Both piped-in and trucked-in domestic waste is discharged directly into the aeration pond.

27342 (DOE/RL–94-24) **State waste discharge permit application, 200-E chemical drain field.** Westinghouse Hanford Co., Richland, WA (United States). Jun 1994. 147p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE94015763. Source: OSTI; NTIS; INIS; GPO Dep.

As part of the Hanford Federal Facility Agreement and Consent Order negotiations (Ecology et al. 1994), the US Department of Energy, Richland Operations Office, the US Environmental Protection Agency, and the Washington State Department of Ecology agreed that liquid effluent discharges to the ground on the Hanford Site which affect groundwater or have the potential to affect ground would be subject to permitting under the structure of Chapter

173-216 (or 173-218 where applicable) of the Washington Administrative Code, the State Waste Discharge Permit Program. As a result of this decision, the Washington State Department of Ecology and the US Department of Energy, Richland Operations Office entered into Consent Order No. DE 91NM-177, (Ecology and DOE-RL 1991). The Consent Order No. DE 91NM-177 requires a series of permitting activities for liquid effluent discharges. This document presents the State Waste Discharge Permit (SWDP) application for the 200-E Chemical Drain Field. Waste water from the 272-E Building enters the process sewer line directly through a floor drain, while waste water from the 2703-E Building is collected in two floor drains, (north and south) that act as sumps and are discharged periodically. The 272-E and 2703-E Buildings constitute the only discharges to the process sewer line and the 200-E Chemical Drain Field.

27343 (DOE/RW–0051/Rev.3) **OCRWM Systems Engineering Management Plan (SEMP): Revision 3.** USDOE Office of Civilian Radioactive Waste Management, Washington, DC (United States). Jun 1994. 107p. Sponsored by USDOE, Washington, DC (United States). Source: OSTI (Free of Charge); INIS.

The Office of Civilian Radioactive Waste Management Systems Engineering Management Plan (OCRWM SEMP) specifies the technical management approach for the development of the waste management system, and specifies the approach for the development of each of the system elements – the waste acceptance system, the transportation system, the Monitored Retrievable Storage (MRS) facility, and the mined geologic disposal system, which includes site characterization activity. The SEMP also delineates how systems engineering will be used by OCRWM to describe the system development process; it identifies responsibilities for its implementation, and specifies the minimum requirements for systems engineering. It also identifies the close interrelationship of system engineering and licensing processes. This SEMP, which is a combined OCRWM and M&O SEMP, is part of the top-level program documentation and is prepared in accordance with the direction provided in the Program Management System Manual (PMSM). The relationship of this document to other top level documents in the CRWMS document hierarchy is defined in the PMSM. A systems engineering management plan for each project, which specifies the actions to be taken in implementing systems engineering at the project level, shall be prepared by the respective project managers. ["Program" refers to the CRWMS-wide activity and "project" refers to that level responsible for accomplishing the specific activities of that segment of the program.] The requirements for the project level SEMPs are addressed in Section 4.2.2.2. They represent the minimum set of requirements, and do not preclude the broadening of systems engineering activities to meet the specific needs of each project.

27344 (DOE/RW/00134–T12) **Total System Performance Assessment, 1993: An evaluation of the potential Yucca Mountain repository.** Andrews, R.W.; Dale, T.F.; McNeish, J.A. INTERA, Inc., Las Vegas, NV (United States). Mar 1994. 410p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC01-91RW00134. Order Number DE94015955. Source: OSTI; NTIS; INIS; GPO Dep.

Total System Performance Assessments are an important component in the evaluation of the suitability of Yucca Mountain, Nevada as a potential site for a mined geologic repository for the permanent disposal of high-level radioactive wastes in the United States. The Total System Performance Assessments are conducted iteratively during site characterization to identify issues which should be addressed by the characterization and design activities as well as providing input to regulatory/licensing and programmatic decisions. During fiscal years 1991 and 1992, the first iteration of Total System Performance Assessment (hereafter referred to as TSPA 1991) was completed by Sandia National Laboratories and Pacific Northwest Laboratory. Beginning in fiscal year 1993, the Civilian Radioactive Waste Management System Management and Operating Contractor was assigned the responsibility to plan, coordinate, and contribute to the second iteration of Total System Performance Assessment (hereafter referred to as TSPA 1993). This document presents the objectives, approach, assumptions, input, results, conclusions, and recommendations associated with the Management and Operating Contractor contribution to TSPA 1993. The new information incorporated in TSPA 1993 includes (1) revised estimates of radionuclide solubilities (and their thermal and geochemical dependency), (2) thermal and geochemical dependency of spent fuel waste alteration and glass dissolution rates, (3) new distribution coefficient (k_d) estimates, (4) revised estimates of gas-phase velocities and travel times, and (5) revised hydrologic modeling of the saturated zone which provides updated estimates of the advective flux through the saturated zone.

27345 (DOE/RW–0441) **Regulatory guidance document.** USDOE Office of Civilian Radioactive Waste Management, Washington, DC (United States). May 1994. 128p. Sponsored by USDOE, Washington, DC (United States). Order Number DE94015371. Source: OSTI; NTIS; INIS; GPO Dep.

The Office of Civilian Radioactive Waste Management (OCRWM) Program Management System Manual requires preparation of the OCRWM Regulatory Guidance Document (RGD) that addresses licensing, environmental compliance, and safety and health compliance. The document provides: regulatory compliance policy; guidance to OCRWM organizational elements to ensure a consistent approach when complying with regulatory requirements; strategies to achieve policy objectives; organizational responsibilities for regulatory compliance; guidance with regard to Program compliance oversight; and guidance on the contents of a project-level Regulatory Compliance Plan. The scope of the RGD includes site suitability evaluation, licensing, environmental compliance, and safety and health compliance, in accordance with the direction provided by Section 4.6.3 of the PMS Manual. Site suitability evaluation and regulatory compliance during site characterization are significant activities, particularly with regard to the YW MSA. OCRWM's evaluation of whether the Yucca Mountain site is suitable for repository development must precede its submittal of a license application to the Nuclear Regulatory Commission (NRC). Accordingly, site suitability evaluation is discussed in Chapter 4, and the general statements of policy regarding site suitability evaluation are discussed in Section 2.1. Although much of the data and analyses may initially be similar, the licensing process is discussed separately in Chapter 5. Environmental compliance is discussed in Chapter 6. Safety and Health compliance is discussed in Chapter 7.

27346 (ECN-C–93-086) **Development and anneal of radiation damage in salt: End report August 1988 - August 1993.** Garcia Celma, A.; Donker, H.; Soppe, W.J.; Miralles, L. Netherlands Energy Research Foundation (ECN), Petten (Netherlands). Dec 1993. 80p. Sponsored by Commission of the European Communities, Brussels (Belgium). Contract CEC F1-1W-0235-E(TT). Order Number DE94789663. Source: OSTI; NTIS; INIS.

Laboratory gamma-irradiations at a constant temperature (100 C) were carried out in two sorts of experiments, one at variable and another at approximately constant dose rates. The damage developed during irradiation was analyzed by thermal analysis, microstructural analysis and small angle neutron scattering. The results were compared with the yields of the Jain-Lidiard model for each experiment. Experiments at a constant dose rate were planned to obtain information on radiation damage development and anneal in conditions as near as possible to those of radioactive waste repository concepts. For this reason the dose rates were kept low. (orig./DG)

27347 (ECN-C–93-095) **Experiments in the HAW project: Data report ECN contribution July - December 1992.** Vonka, V.; Middleton, D.W.; Ruiter, A. de. Netherlands Energy Research Foundation (ECN), Petten (Netherlands). Dec 1993. 129p. Sponsored by Commission of the European Communities, Brussels (Belgium). Contract CEC FI-1W-0003-D(B). Order Number DE94789631. Source: OSTI; NTIS; INIS.

This data report is the eighth of a series intended to document the data obtained from the HAW in situ experiment (at Asse) and to make these data available to potential users. During this experiment a considerable number of thermocouples was damaged so that their signals are lost. In some cases it resulted in plots with no signal but empty frames. In the previous report we tried to change

our procedure and remove these frames from the report. This action was not completely successful because, as it turned out, also some of the not empty plots were removed wrongly as well. (orig.)

27348 (ECN-I–93-049) **The mobilisation model and parameter sensitivity: For subrosion and diapirism of a salt repository.** Blok, B.M. Netherlands Energy Research Foundation (ECN), Petten (Netherlands). Dec 1993. 71p. Order Number DE94789636. Source: OSTI; NTIS; INIS.

In the PRObabillistic Safety Assessment (PROSA) of radioactive waste in a salt repository one of the nuclide release scenario's is the subrosion scenario. A new subrosion model SUBRECN has been developed. In this model the combined effect of a depth-dependent subrosion, glass dissolution, and salt rise has been taken into account. The subrosion model SUBRECN and the implementation of this model in the German computer program EMOS4 is presented. A new computer program PANTER is derived from EMOS4. PANTER models releases of radionuclides via subrosion from a disposal site in a salt pillar into the biosphere. For uncertainty and sensitivity analyses the new subrosion model Latin Hypercube Sampling has been used for determine the different values for the uncertain parameters. The influence of the uncertainty in the parameters on the dose calculations has been investigated by the following sensitivity techniques: Spearman Rank Correlation Coefficients, Partial Rank Correlation Coefficients, Standardised Rank Regression Coefficients, and the Smirnov Test. (orig./HP)

27349 (ECN-R–94-001) **Transmutation of fission products in reactors and accelerator-driven systems: Some critical remarks.** Janssen, A.J. Netherlands Energy Research Foundation (ECN), Petten (Netherlands). Jan 1994. 21p. Order Number DE94789630. Source: OSTI; NTIS; INIS.

Energy flows and mass flows in several scenarios are considered. Economical and safety aspects of the transmutation scenarios are compared. It is difficult to find a sound motivation for the transmutation of fission products with accelerator-driven systems. If there would be any hesitation in transmuting fission products in nuclear reactors, there would be an even stronger hesitation to use accelerator-driven systems, mainly because of their lower energy efficiency and their poor cost effectiveness. The use of accelerator-driven systems could become a 'meaningful' option only if nuclear energy would be banished completely. (orig./HP)

27350 (EGG-MS–10941) **Modified IRC bench-scale arc melter for waste processing.** Eddy, T.L.; Sears, J.W.; Grandy, J.D.; Kong, P.C.; Watkins, A.D. EG and G Idaho, Inc., Idaho Falls, ID (United States). Mar 1994. 34p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE94015316. Source: OSTI; NTIS; INIS; GPO Dep.

This report describes the INEL Research Center (IRC) arc melter facility and its recent modifications. The arc melter can now be used to study volatilization of toxic and high vapor pressure metals and the effects of reducing and oxidizing (redox) states in the melt. The modifications include adding an auger feeder, a gas flow control and monitoring system, an offgas sampling and exhaust system, and a baghouse filter system, as well as improving the electrode drive, slag sampling system, temperature measurement and video monitoring and recording methods, and oxidation lance. In addition to the volatilization and redox studies, the arc melter facility has been used to produce a variety of glass/ceramic waste forms for property evaluation. Waste forms can be produced on a daily basis. Some of the melts performed are described to illustrate the melter's operating characteristics.

27351 (EGG-RWMC–11190) **Radiological, physical, and chemical characterization of transuranic wastes stored at the Idaho National Engineering Laboratory.** Apel, M.L.; Becker, G.K.; Ragan, Z.K.; Frasure, J.; Raivo, B.D.; Gale, L.G.; Pace, D.P. EG and G Idaho, Inc., Idaho Falls, ID (United States). Mar 1994. 960p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE94015385. Source: OSTI; NTIS; INIS; GPO Dep.

This document provides radiological, physical and chemical characterization data for transuranic radioactive wastes and transuranic radioactive and hazardous (i.e., mixed) wastes stored at the Idaho National Engineering Laboratory and considered for treatment under the Private Sector Participation Initiative Program (PSPI). Waste characterization data are provided in the form of INEL Waste Profile Sheets. These documents provide, for each content code, information on waste identification, waste description, waste storage configuration, physical/chemical waste composition, radionuclide and associated alpha activity waste characterization data, and hazardous constituents present in the waste. Information is provided for 139 waste streams which represent an estimated total volume of 39,380^3 corresponding to a total mass of approximately 19,000,000 kg. In addition, considerable information concerning alpha, beta, gamma, and neutron source term data specific to Rocky Flats Plant generated waste forms stored at the INEL are provided to assist in facility design specification.

27352 (EGG-WM–10924) **INEL D&D Long-Range Plan.** Buckland, R.J.; Kenoyer, D.J.; Preussner, D.H. EG and G Idaho, Inc., Idaho Falls, ID (United States). Oct 1993. 259p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE94010706. Source: OSTI; NTIS; INIS; GPO Dep.

This Long-Range Plan presents the Decontamination and Decommissioning (D&D) Program planning status for facilities at the Idaho National Engineering Laboratory (INEL). The plan provides a general description of the D&D Program objectives, management criteria, and philosophy; discusses current activities; and documents the INEL D&D Program cost and schedule estimate projections for the next 15 years. appendices are included that provide INEL D&D project historical information and a comprehensive descriptive summary of each current surplus facility.

27353 (EGG-WM–11053) **Project Management Plan for the Idaho National Engineering Laboratory Waste Isolation Pilot Plant Experimental Test Program.** Connolly, M.J.; Sayer, D.L. EG and G Idaho, Inc., Idaho Falls, ID (United States). Nov 1993. 40p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE94015383. Source: OSTI; NTIS; INIS; GPO Dep.

EG&G Idaho, Inc. and Argonne National Laboratory-West (ANL-W) are participating in the Idaho National Engineering Laboratory's (INEL's) Waste Isolation Pilot Plant (WIPP) Experimental Test Program (WETP). The purpose of the INEL WET is to provide chemical, physical, and radiochemical data on transuranic (TRU) waste to be stored at WIPP. The waste characterization data collected will be used to support the WIPP Performance Assessment (PA), development of the disposal No-Migration Variance Petition (NMVP), and to support the WIPP disposal decision. The PA is an analysis required by the Code of Federal Regulations (CFR), Title 40, Part 191 (40 CFR 191), which identifies the processes and events that may affect the disposal system (WIPP) and examines the effects of those processes and events on the performance of WIPP. A NMVP is required for the WIPP by 40 CFR 268 in order to dispose of land disposal restriction (LDR) mixed TRU waste in WIPP. It is anticipated that the detailed Resource Conservation and Recovery Act (RCRA) waste characterization data of all INEL retrievably-stored TRU waste to be stored in WIPP will be required for the NMVP. Waste characterization requirements for PA and RCRA may not necessarily be identical. Waste characterization requirements for the PA will be defined by Sandia National Laboratories. The requirements for RCRA are defined in 40 CFR 268, WIPP RCRA Part B Application Waste Analysis Plan (WAP), and WIPP Waste Characterization Program Plan (WWCP). This Project Management Plan (PMP) addresses only the characterization of the contact handled (CH) TRU waste at the INEL. This document will address all work in which EG&G Idaho is responsible concerning the INEL WETP. Even though EG&G Idaho has no responsibility for the work that ANL-W is performing, EG&G Idaho will keep a current status and provide a project coordination effort with ANL-W to ensure that the INEL, as a whole, is effectively and efficiently completing the requirements for WETP.

27354 (EGG-WM–11105) **Operational readiness review for the Waste Experimental Reduction Facility: Final report.** EG and G Idaho, Inc., Idaho Falls, ID (United States). Nov 1993. 511p. Sponsored by USDOE, Washington, DC (United States). DOE

Contract AC07-76ID01570. Order Number DE94008526. Source: OSTI; NTIS; INIS; GPO Dep.

An Operational Readiness Review (ORR) at the Idaho National Engineering Laboratory's (INEL's) Waste Experimental Reduction Facility (WERF) was conducted by EG&G Idaho, Inc., to verify the readiness of WERF to resume operations following a shutdown and modification period of more than two years. It is the conclusion of the ORR Team that, pending satisfactory resolution of all pre-startup findings, WERF has achieved readiness to resume unrestricted operations within the approved safety basis. ORR appraisal forms are included in this report.

27355 (EGG-WROC–11152) **Hazards assessment for the INEL Landfill Complex.** Knudsen, J.K.; Calley, M.B. EG and G Idaho, Inc., Idaho Falls, ID (United States). Feb 1994. 21p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE94015255. Source: OSTI; NTIS; INIS; GPO Dep.

This report documents the hazards assessment for the INEL Landfill Complex (LC) located at the Idaho National Engineering Laboratory, which is operated by EG&G Idaho, Inc., for the US Department of Energy (DOE). The hazards assessment was performed to ensure that this facility complies with DOE and company requirements pertaining to emergency planning and preparedness for operational emergencies. DOE Order 5500.3A requires that a facility-specific hazards assessment be performed to provide the technical basis for facility emergency planning efforts. This hazards assessment was conducted in accordance with DOE Headquarters and the DOE Idaho Operations Office (DOE-ID) guidance to comply with DOE Order 5500.3A. The hazards assessment identifies and analyzes the hazards that are significant enough to warrant consideration in a facility's operational emergency management program. The area surrounding the LC, the buildings and structures at the LC, and the processes that are used at the LC are described in this report. All hazardous materials, both radiological and nonradiological, at the LC were identified and screened against threshold quantities according to DOE Order 5500.3A guidance. Asbestos at the Asbestos Pit was the only hazardous material that exceeded its specified threshold quantity. However, the type of asbestos received and the packaging practices used are believed to limit the potential for an airborne release of asbestos fibers. Therefore, in accordance with DOE Order 5500.3A guidance, no further hazardous material characterization or analysis was required for this hazards assessment.

27356 (EGG-WTD–11199) **Design requirements for the supercritical water oxidation test bed.** Svoboda, J.M.; Valentich, D.J. EG and G Idaho, Inc., Idaho Falls, ID (United States). May 1994. 74p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE94015260. Source: OSTI; NTIS; INIS; GPO Dep.

This report describes the design requirements for the supercritical water oxidation (SCWO) test bed that will be located at the Idaho National Engineering Laboratory (INEL). The test bed will process a maximum of 50 gph of waste plus the required volume of cooling water. The test bed will evaluate the performance of a number of SCWO reactor designs. The goal of the project is to select a reactor that can be scaled up for use in a full-size waste treatment facility to process US Department of Energy mixed wastes. EG&G Idaho, Inc. will design and construct the SCWO test bed at the Water Reactor Research Test Facility (WRRTF), located in the northern region of the INEL. Private industry partners will develop and provide SCWO reactors to interface with the test bed. A number of reactor designs will be tested, including a transpiring wall, tube, and vessel-type reactor. The initial SCWO reactor evaluated will be a transpiring wall design. This design requirements report identifies parameters needed to proceed with preliminary and final design work for the SCWO test bed. A flow sheet and Process and Instrumentation Diagrams define the overall process and conditions of service and delineate equipment, piping, and instrumentation sizes and configuration Codes and standards that govern the safe engineering and design of systems and guidance that locates and interfaces test bed hardware are provided. Detailed technical requirements are addressed for design of piping, valves, instrumentation and control, vessels, tanks, pumps, electrical systems, and structural steel. The approach for conducting the preliminary and final designs and environmental and quality issues influencing the design are provided.

27357 (EGG-WTD–11208) **Test plan for preparing the Rapid Transuranic Monitoring Laboratory for field deployment.** McIsaac, C.V.; Sill, C.W.; Gehrke, R.J.; Killian, E.W.; Watts, K.D. EG and G Idaho, Inc., Idaho Falls, ID (United States). Apr 1994. 60p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE94015289. Source: OSTI; NTIS; INIS; GPO Dep.

This plan describes experimental work that will be performed during fiscal year 1994 to prepare the Rapid Transuranic Monitoring Laboratory (RTML) for routine field use by US Department of Energy (DOE) Environmental Restoration and Waste Management programs. The RTML is a mobile, field-deployable laboratory developed at the Idaho National Engineering Laboratory (INEL) that provides a rapid, cost-effective means of characterizing and monitoring radioactive waste remediation sites for low-level radioactive contaminants. Analytical instruments currently installed in the RTML include an extended-range, germanium photon analysis spectrometer with an automatic sample changer; two, large-area, ionization chamber alpha spectrometers; and four alpha continuous air monitors. The RTML was field tested at the INEL during June 1993 in conjunction with the Buried Waste Integrated Demonstration's remote retrieval demonstration. The major tasks described in this test plan are to (a) evaluate the beta detectors for use in screening soil samples for ^{90}Sr, (b) upgrade the alpha spectral analysis software programs, and (c) upgrade the photon spectral analysis software programs.

27358 (EGG-WTD–11271) **Supercritical water oxidation test bed effluent treatment study.** Barnes, C.M. EG and G Idaho, Inc., Idaho Falls, ID (United States). Apr 1994. 40p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE94015261. Source: OSTI; NTIS; INIS; GPO Dep.

This report presents effluent treatment options for a 50 h Supercritical Water Test Unit. Effluent compositions are calculated for eight simulated waste streams, using different assumed cases. Variations in effluent composition with different reactor designs and operating schemes are discussed. Requirements for final effluent compositions are briefly reviewed. A comparison is made of two general schemes. The first is one in which the effluent is cooled and effluent treatment is primarily done in the liquid phase. In the second scheme, most treatment is performed with the effluent in the gas phase. Several unit operations are also discussed, including neutralization, mercury removal, and evaporation.

27359 (FEMP–2324) **Waste container fabrication from recycled DOE metal.** Motl, G.P.; Burns, D.D. Fernald Environmental Restoration Management Corp., Cincinnati, OH (United States). Fernald Environmental Management Project. 15 Feb 1994. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-92OR21972. (CONF-940225–117: Waste management '94, Tucson, AZ (United States), 27 Feb - 3 mar 1994). Order Number DE94015814. Source: OSTI; NTIS; INIS; GPO Dep.

The Department of Energy (DOE) has more than 2.5 million tons of radioactive scrap metal (RSM) that is either in inventory or expected to be generated over the next 25 years as major facilities within the weapons complex are decommissioned. Much of this material cannot be surface decontaminated. In an attempt to conserve natural resources and to avoid burial of this material at DOE disposal sites, options are now being explored to "beneficially reuse" this material in applications where small amounts of radioactivity are not a detriment. One example is where RSM is currently being beneficially used to fabricate shield blocks for use in DOE medium energy physics programs. This paper describes other initiatives now underway within DOE to utilize RSM to fabricate other products, such as radioactive waste shipping, storage and disposal containers.

27360 (FRCEA-TH–400) **Part of organic matter in actinides retention phenomena on silica.** Labonne, N. CEA Centre d'Etudes de Cadarache, 13 - Saint-Paul-lez-Durance (France).

Dept. Stockage Dechets; Paris-11 Univ., 91 - Orsay (France). Nov 1993. 274p. (In French). Order Number DE94632845. Source: OSTI; NTIS (US Sales Only); INIS.

In the framework of studies concerning radioactive waste storage, the understanding of radionuclides dispersion processes in a site needs the study of different mechanisms able to reduce or increase a possible radionuclides migration. That in this aim that we made works on the part of organic matters (humic and fulvic acids) in mechanisms of radionuclides sorption (Am(III), Np(V), U(VI)) on silica.

27361 (FRCEA-TH–418) **A causal reasoning for the simulation of continuous industrial processes.** Leyval, L. CEA Centre d'Etudes de Grenoble, 38 (France); Institut National Polytechnique, 38 - Grenoble (France). 21 Jun 1991. 220p. (In French). Order Number DE94632832. Source: OSTI; NTIS (US Sales Only); INIS.

This report describes an on-line simulation tool to be integrated in a supervision support system for industrial continuous processes. The aim is to provide operators with the future behaviour of the process after significant modifications have been detected on some inputs or on measurable disturbances. A nuclear waste processing plant is used to illustrate the method: the process is modeled by a causal graph, whose nodes are the variables relevant for the operators, and the arcs the cause-effect relationships between them. Each of the arcs support a qualitative transfer function (QTF), parameterized by a delay, a static gain and a settling time. This model is the knowledge base used by the simulator. The evolution of a variable is represented by a piecewise linear function. The simulation algorithm aims to propagate the evolutions from a variable into another one in the graph thanks to the QTFs. It leads to the concept of event, a basic function constituted with a step and a ramp. 38 fig., 6 ref.

27362 (HLW-OVP–94-0005) **HLW system plan - revision 2.** Westinghouse Savannah River Co., Aiken, SC (United States). 14 Jan 1994. 118p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035. Order Number DE94016435. Source: OSTI; NTIS; INIS; GPO Dep.

The projected ability of the Tank Farm to support DWPF startup and continued operation has diminished somewhat since revision 1 of this Plan. The 13 month delay in DWPF startup, which actually helps the Tank Farm condition in the near term, was more than offset by the 9 month delay in ITP startup, the delay in the Evaporator startups and the reduction to Waste Removal funding. This Plan does, however, describe a viable operating strategy for the success of the HLW System and Mission, albeit with less contingency and operating flexibility than in the past. HLWM has focused resources from within the division on five near term programs: The three evaporator restarts, DWPF melter heatup and completion of the ITP outage. The 1H Evaporator was restarted 12/28/93 after a 9 month shutdown for an extensive Conduct of Operations upgrade. The 2F and 2H Evaporators are scheduled to restart 3/94 and 4/94, respectively. The RHLWE startup remains 11/17/97.

27363 (HW–84001) **Activity of irradiated regular metal in buckets.** Smith, R.H. Pacific Northwest Lab., Richland, WA (United States). 14 Sep 1964. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE94017032. Source: OSTI; NTIS; GPO Dep.

The potential of shipping a bucket of metal that has not had sufficient decay time is a common problem to all Reactor Processing Operations. The only method at present to assure shipping adequately decayed metal is by procedural control. This study was performed to determine the feasibility of establishing decay time for irradiated metal in buckets by radiation activity measurements.

27364 (JAERI-M–94-027) **Progress report on safety research on radioactive waste management for the period April 1992 to March 1993.** Muraoka, Susumu (Japan Atomic Energy Research Inst., Tokai, Ibaraki (Japan). Tokai Research Establishment); Senoo, Muneaki; Sekine, Keiichi (eds.). Japan Atomic Energy Research Inst., Tokyo (Japan). Mar 1994. 136p. Order Number DE94785278. Source: OSTI; NTIS; INIS.

This report summarizes the research and development activities on radioactive waste management at the Engineered Barrier Materials Laboratory, Shallow Land Migration Laboratory, Environmental Geochemistry Laboratory and Environmental Radiochemistry Laboratory of the Department of Environmental Safety Research during the fiscal year of 1992 (April 1, 1992-March 31, 1993). The topics are as follows: (1) As for waste forms and engineered barrier material, performance assessment studies were carried out on various waste forms, buffer materials and mortar. (2) In the safety evaluation study for shallow land disposal, migration behavior in the soil layer were studied. (3) In the safety evaluation study for geological disposal, chemical behavior of nuclide in water, nuclide migration and fixation in geosphere were studied. (4) Distribution of uranium and migration of uranium series nuclide in uranium ore were examined as a natural analogue study. (author).

27365 (JAERI-M–94-067) **Technology assessment of partitioning process. 1: Status of the partitioning technology.** Kondo, Yasuo (Japan Atomic Energy Research Inst., Tokai, Ibaraki (Japan). Tokai Research Establishment); Takitsuka, Takakazu. Japan Atomic Energy Research Inst., Tokyo (Japan). Mar 1994. 114p. (In Japanese). Order Number DE94785241. Source: OSTI; NTIS; INIS.

In order to collect a good grounding in assessment of the partitioning process, present and future trends on the partitioning technologies were surveyed. The research activities on the partitioning process are devided broadly into two categolies; the process for LWR fuel and the process for transmutation system fuel. Some wet processes, which were attached to the PUREX process through the high level liquid waste, were designed as the process for LWR fuel in the U.S., Europe and Japan. The engineering data, concerned about separation efficiency, amount of secondary waste, deconposed rate of solvent and so on, has been accumulated at the JAERI. It is to be desired that the partitioning process for the transmutation system fuel should be designed as the process exclusive to the indivisual transmutation system. In this case, pyrochemical processes are often introduced because of their simplicity, criticality safety, minimization of secondary waste and so on. The technical data concerned about pyrochemical processing have been accumulated in the U.S. and Japan. These efforts will soon prove the technical feasibility of the pyrochemical processes. (author).

27366 (LA–12786) **The Los Alamos Super Scrub™: Supercritical carbon dioxide system utilities and consumables study.** Barton, J.C. Los Alamos National Lab., NM (United States). Jun 1994. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. Order Number DE94013645. Source: OSTI; NTIS; GPO Dep.

A study was undertaken to determine the electrical and other utilities usage of the Super Scrub™ system. The purpose of the experiments being conducted at Los Alamos is to prove or disprove the feasibility of precision cleaning for solvent and waste reduction using supercritical carbon dioxide. An actual dollars value-versus-time has been calculated for predetermined pressures, flows, and temperatures. State-of-the-art menu- and softwaredriven instrumentation were utilized to generate exacting results. It is hoped that these results will prove of immediate benefit to those industries interested in but concerned about the cost of changing over to carbon dioxide cleaning on both small- and large-scale operations.

27367 (LA–12793-MS) **Scale-up of the SY-102 remediation flowsheet.** Punjak, W.A.; Yarbro, S.L.; Schreiber, S.B.; Dunn, S.L.; Ortiz, E.M.; Day, R.S.; Thomas, K.W. Los Alamos National Lab., NM (United States). Aug 1994. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. Order Number DE94017064. Source: OSTI; NTIS; INIS; GPO Dep.

An anion exchange unit operation for the removal of actinides from a high-nitrate, low-acid solution was successfully scaled up more than one order of magnitude. The behavior of the scaled-up system was similar in many ways to the previous small-scale experiments. It was characterized by a slow approach to equilibrium, displacement of americium by the other actinides, and improved column performance with increasing column length. With reasonable accuracy, the authors predicted for the larger system the breakthrough of americium, the most weakly sorbed actinide of those present.

27368 (LA-SUB–94-17) **Support to LANL: Cost estimation: Final report.** Los Alamos National Lab., NM (United States); ICF Kaiser Engineers, Inc., Fairfax, VA (United States). 4 Oct 1993. 152p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. Order Number DE94015420. Source: OSTI; NTIS; INIS; GPO Dep.

This report summarizes the activities and progress by ICF Kaiser Engineers conducted on behalf of Los Alamos National Laboratories (LANL) for the US Department of Energy, Office of Waste Management (EM-33) in the area of improving methods for Cost Estimation. This work was conducted between October 1, 1992 and September 30, 1993. ICF Kaiser Engineers supported LANL in providing the Office of Waste Management with planning and document preparation services for a Cost and Schedule Estimating Guide (Guide). The intent of the Guide was to use Activity-Based Cost (ABC) estimation as a basic method in preparing cost estimates for DOE planning and budgeting documents, including Activity Data Sheets (ADSs), which form the basis for the Five Year Plan document. Prior to the initiation of the present contract with LANL, ICF Kaiser Engineers was tasked to initiate planning efforts directed toward a Guide. This work, accomplished from June to September, 1992, included visits to eight DOE field offices and consultation with DOE Headquarters staff to determine the need for a Guide, the desired contents of a Guide, and the types of ABC estimation methods and documentation requirements that would be compatible with current or potential practices and expertise in existence at DOE field offices and their contractors.

27369 (LA-SUB–94-92) **Yucca Mountain Project Integrated Data System (IDS): Final report, October 1, 1989–December 31, 1990.** Los Alamos National Lab., NM (United States); Computer Applications Group, Inc., Carlton, OR (United States). 23 May 1991. 166p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. Order Number DE94017052. Source: OSTI; NTIS; INIS; GPO Dep.

This final report for LANL Subcontract 9-XS8-2604-1 includes copies of all formal letters, memorandums, and reports provided by CAG to support the IDS effort in the LANL Test Managers Office, Las Vegas, Nevada from October 1, 1989 through the end of the contract on December 31, 1990. The material is divided into two sections; the Functional Requirements Document (FRD) and other reports, letters, and memorandums. All documents are arranged in chronological order with most recent last. Numerous draft copies of the FRD were prepared and cover sheets for all drafts are included. The complete text of only the last version supplied (July 27, 1990) is included in this document.

27370 (LA-SUB–94-109) **1992-93 Results of geomorphological and field studies Volcanic Studies Program, Yucca Mountain Project.** Wells, S.G. Los Alamos National Lab., NM (United States). Oct 1993. 51p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. Order Number DE94017065. Source: OSTI; NTIS; INIS; GPO Dep.

Field mapping and stratigraphic studies were completed of the Black Tank volcanic center, which represents the southwestern most eruptive center in the Cima volcanic field of California. The results of this mapping are presented. Contacts between volcanic units and geomorphic features were field checked, incorporating data from eight field trenches as well as several exposures along Black Tank Wash. Within each of the eight trenches, logs were measured and stratigraphic sections were described. These data indicate that three, temporally separate volcanic eruptions occurred at the Black Tank center. The field evidence for significant time breaks between each stratigraphic unit is the presence of soil and pavement-bounded unconformities.

27371 (LA-UR–94-1429) **An overview of accelerator-driven transmutation technology.** Heighway, E.A. Los Alamos National Lab., NM (United States). [1994]. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-9404184–1: LAMPF user's group meeting, Washington, DC (United States), 20 Apr 1994). Order Number DE94014724. Source: OSTI; NTIS; INIS; GPO Dep.

Accelerator-Driven Transmutation Technology, or ADT^2, is a collection of programs that share a common theme - they each have at their heart an intense source of neutrons generated by a high-energy proton beam striking a heavy metal target. The beam energy, typically 1000 MeV, is enough for a single proton to smash a target atom into atomic fragments. This so-called spallation process generates large numbers of neutrons (around 20 to 30 per proton) amid the atomic debris. These neutrons are of high value because they can be used to transmute neighboring atoms by neutron capture. Three distinct ADT^2 program elements will be described. These are ADEP - accelerator-driven energy production, ABC - accelerator based conversion (of plutonium) and ATW - accelerator transmutation of waste.

27372 (LA-UR–94-1461) **Next generation storage facility.** Schlesser, J.A. Los Alamos National Lab., NM (United States). [1994]. 14p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-9405144–2: Nuclear criticality technology safety project workshop, Williamsburg, VA (United States), 10-11 May 1994). Order Number DE94011710. Source: OSTI; NTIS; INIS; GPO Dep.

With diminishing requirements for plutonium, a substantial quantity of this material requires special handling and ultimately, long-term storage. To meet this objective, we at Los Alamos, have been involved in the design of a storage facility with the goal of providing storage capabilities for this and other nuclear materials. This paper presents preliminary basic design data, not for the structure and physical plant, but for the container and arrays which might be configured within the facility, with strong emphasis on criticality safety features.

27373 (LA-UR–94-2019) **Evaluating detonation possibilities in a Hanford radioactive waste tank.** Travis, J.R. (Los Alamos National Lab., NM (United States)); Fujita, R.K.; Ross, M.C.; Edwards, J.N.; Shepherd, J.E. Los Alamos National Lab., NM (United States). [1994]. 15p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-931160–45: American Nuclear Society (ANS) winter meeting, San Francisco, CA (United States), 14-18 Nov 1993). Order Number DE94014291. Source: OSTI; NTIS; INIS; GPO Dep.

Since the early 1940s, radioactive wastes generated from the defense operations at the Hanford Site have been stored in underground waste storage tanks. During the intervening years, the waste products in some of these tanks have transformed into a potentially hazardous mixture of gases and solids as a result of radiolytic and thermal chemical reactions. One tank in particular, Tank 101-SY, has been periodically releasing high concentrations of a hydrogen/nitrous oxide/nitrogen/ammonia gas mixture into the tank dome vapor space. There are concerns that under certain conditions a detonation of the flammable gas mixture may occur. There are two ways that a detonation can occur during a release of waste gases into the dome vapor splice: (1) direct initiation of detonation by a powerful ignition source, and (2) deflagration to detonation transition (DDT). The first case involves a strong ignition source of high energy, high power, or of large size (roughly 1 g of high explosive (4.6 kj) for a stoichiometric hydrogen-air mixture[1]) to directly initiate a detonation by "shock" initiation. This strong ignition is thought to be incredible for in-tank ignition sources. The second process involves igniting the released waste gases, which results in a subsonic flame (deflagration) propagating into the unburned combustible gas. The flame accelerates to velocities that cause compression waves to form in front of the deflagration combustion wave. Shock waves may form, and the combustion process may transition to a detonation wave.

27374 (LA-UR–94-2245) **Vadose zone drilling at the NTS.** Efurd, D.W. Los Alamos National Lab., NM (United States). [1994]. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. Order Number DE94016080. Source: OSTI; NTIS; INIS; GPO Dep.

The Yucca Mountain Project has an opportunity to evaluate possible mobilization and transport of radioactive materials away from the storage horizon in the proposed repository. One scenario by which such transport could occur involves water leaving the storage area and carrying radioactive particulates of colloidal size. The colloids could move along the gas-liquid interface in partially filled fractures within the vadose zone. It should be possible to check the reality of this proposed scenario by examining "anthropogenic

analogs" of the repository. These are sites of nuclear tests conducted in unsaturated tuff at the Nevada Test Site (NTS). We propose to drill under one or more such sites to determine if radionuclides have moved from their original confinement in the puddle- glass at the bottom of the cavity. This document examines the characteristics of an ideal test site for such a study, suggests several possible locations that have some of the desired characteristics, and recommends one of these sites for the proposed drilling.

27375 (LA-UR–94-2474) **Evaluation of waste crate counter.** Wachter, J.R. (Los Alamos National Lab., NM (United States). Nuclear Materials Measurement and Accountability); Bieri, J.M.; Shaw, S.W. Los Alamos National Lab., NM (United States). [1994]. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-940748–52: Institute of Nuclear Materials Management annual meeting, Naples, FL (United States), 17-20 Jul 1994). Order Number DE94016167. Source: OSTI; NTIS; INIS; GPO Dep.

A novel nondestructive measurement system has been developed to perform combined gamma-ray, passive neutron, and active neutron analyses of radioactive waste packaged in large crates. The system will be used to examine low level and transuranic waste at the Waste Receiving and Processing facility at Westinghouse-Hanford Corp. Prior to delivery of the system, an extensive evaluation of its performance characteristics will be conducted. The evaluation is to include an assessment of the mechanical properties of the system, gamma-ray attenuation correction algorithms, instrument response as a function of source positions, performance of the high resolution gamma-ray detector for "hot spot" and isotopic analyses, active and passive neutron counter response, instrument sensitivity, matrix effects, and packaging effects. This report will discuss the findings of the evaluation program, to date, and indicate future directions for the program.

27376 (LA-UR–94-2532) **Nuclear data requirements for accelerator-driven transmutation systems.** Young, P.G. (Los Alamos National Lab., NM (United States). Nuclear Theory and Applications Group); Wilson, W.B.; Chadwick, M.B. Los Alamos National Lab., NM (United States); Lawrence Livermore National Lab., CA (United States). [1994]. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36 ; W-7405-ENG-48. (CONF-9407103–1: International conference on accelerated-driven transmutation technologies and applications, Las Vegas, NV (United States), 25-28 Jul 1994). Order Number DE94016214. Source: OSTI; NTIS; INIS; GPO Dep.

The possibilities of several new technologies based on use of intense, medium-energy proton accelerators are being investigated at Los Alamos National Laboratory. The potential new areas include destruction of long-lived components of nuclear waste, plutonium burning, energy production, and production of tritium. The design, assessment, and safety analysis of potential facilities involves the understanding of complex combinations of nuclear processes, which in turn places new requirements on nuclear data that transcend the traditional needs of the fission and fusion reactor communities. In this paper an assessment of the nuclear data needs for systems currently being considered in the Los Alamos Accelerator-Driven Transmutation Technologies program is given. The importance of developing neutron and proton cross section libraries in the incident particle energy range of 20 MeV to approximately 200 MeV for transport applications is discussed, and new theoretical methods for developing cross section libraries at higher incident neutron and proton energies are summarized.

27377 (LBL–35909) **Stochastic modeling of spatial heterogeneities conditioned to hydraulic and tracer tests.** Datta Gupta, A. (Lawrence Berkeley Lab., CA (United States)); Vasco, D.W.; Long, J.C.S.; Vomvoris, S. Lawrence Berkeley Lab., CA (United States). Jul 1994. 9p. Sponsored by USDOE, Washington, DC (United States);Swiss National Cooperative for the Storage of Nuclear Waste, Baden (Switzerland). DOE Contract AC03-76SF00098. (CONF-940553–79: International high-level radioactive waste management conference, Las Vegas, NV (United States), 22-26 May 1994). Order Number DE94016218. Source: OSTI; NTIS; GPO Dep.

Uncertainty concerning the physical and chemical nature of subsurface heterogeneities constitutes a severe technical barrier to assessing long term performance of nuclear waste repositories. This paper discusses an approach to generation of stochastic permeability fields through simultaneous inversion of flow and transport data. For tracer transport calculations, we have used a semianalytic transit time algorithm which is fast, accurate and free from numerical dispersion. The inversion of data has been accomplished through the use of simulated annealing. We have addressed the non-uniqueness associated with our results by shifting the focus from the search for a single model that fits the data best to inferences about the properties that are shared by an ensemble of acceptable models. We then determine a most likely model for heterogeneity. The approach has been illustrated through application to tracer migration in a synthetic fracture plane.

27378 (NEI-DK–1567) **The Nordic programme on waste and decommissioning (KAN) 1990-93.** Nordisk Kernesikkerhedsforskning, Roskilde (Denmark). Mar 1994. 27p. Order Number DE94632826. Source: OSTI; NTIS; INIS.

In assessing nuclear waste safety, both long term and short term aspects need to be considered. For the development of a system for the final disposal of spent nuclear fuel, the most challenging task is to develop a sufficient understanding of the long term safety of a potential repository. Two of the NKS-projects are directly relevant for the long term safety of a deep geological repository, whereas the other projects mainly concern issues in managing nuclear waste today. Information about repositories and their contents must be conserved so that it can be easily retrieved. The KAN-1.3 studies deal with available information and how to preserve it. Archive safety as well as the expected durability of different archive media is explored. An important part of the KAN-3 project has been to assemble field evidence, such as historic data indicating effects of past glaciations. The potential impact of a future glaciation on a repository is also explored in this project. An unlikely accident at a nuclear power plant could result in deposition of radioactive elements in the environment so that cleanup becomes necessary. In the KAN-2 project waste volumes and activities in different environments are estimated. Experiments have been performed with soil removal, and with cement solidification, and cost-benefit analyses are developed for use in emergency planning. Clearance of radioactive materials from regulatory control may reduce waste volumes that must otherwise be handled as radioactive, especially in conjunction with decommissioning. In the KAN-1.1 project the essential aspects of the clearance problems are dealt with such as definitions, radiological assessments, monitoring, and preparation of a clearance application. Eventually all nuclear installations in the Nordic countries will have to be decommissioned. In the KAN-1.2 project, the decommissioning of a pilot reprocessing plant is documented and the practical experiences recorded. (Abstract Truncated)

27379 (NUREG–1307-Rev.4) **Report on waste burial charges: Escalation of decommissioning waste disposal costs at low-level waste burial facilities, Revision 4.** Nuclear Regulatory Commission, Washington, DC (United States). Div. of Regulatory Applications. Jun 1994. 50p. Sponsored by Nuclear Regulatory Commission, Washington, DC (United States). Source: OSTI; NTIS; INIS; GPO.

One of the requirements placed upon nuclear power reactor licensees by the U.S. Nuclear Regulatory Commission (NRC) is for the licensees to periodically adjust the estimate of the cost of decommissioning their plants, in dollars of the current year, as part of the process to provide reasonable assurance that adequate funds for decommissioning will be available when needed. This report, which is scheduled to be revised periodically, contains the development of a formula for escalating decommissioning cost estimates that is acceptable to the NRC. The sources of information to be used in the escalation formula are identified, and the values developed for the escalation of radioactive waste burial costs, by site and by year, are given. The licensees may use the formula, the coefficients, and the burial escalation factors from this report in their escalation analyses, or they may use an escalation rate at least equal to the escalation approach presented herein. This fourth revision of NUREG-1307 contains revised spreadsheet results for the disposal costs for the reference PWR and the reference BWR and the ratios of disposal costs at the Washington, Nevada, and South

Carolina sites for the years 1986, 1988, 1991 and 1993, superseding the values given in the May 1993 issue of this report. Burial cost surcharges mandated by the Low-Level Radioactive Waste Policy Amendments Act of 1985 (LLRWPAA) have been incorporated into the revised ratio tables for those years. In addition, spreadsheet results for the disposal costs for the reference reactors and ratios of disposal costs at the two remaining burial sites in Washington and South Carolina for the year 1994 are provided. These latter results do not include any LLRWPAA surcharges, since those provisions of the Act expired at the end of 1992. An example calculation for escalated disposal cost is presented, demonstrating the use of the data contained in this report.

27380 (ORNL/TM–12759) **Final waste forms project: Performance criteria for phase I treatability studies.** Gilliam, T.M. (Oak Ridge National Lab., TN (United States)); Hutchins, D.A.; Chodak, P. III. Oak Ridge National Lab., TN (United States). Jun 1994. 135p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE94015934. Source: OSTI; NTIS; INIS; GPO Dep.

This document defines the product performance criteria to be used in Phase I of the Final Waste Forms Project. In Phase I, treatability studies will be performed to provide "proof-of-principle" data to establish the viability of stabilization/solidification (S/S) technologies. This information is required by March 1995. In Phase II, further treatability studies, some at the pilot scale, will be performed to provide sufficient data to allow treatment alternatives identified in Phase I to be more fully developed and evaluated, as well as to reduce performance uncertainties for those methods chosen to treat a specific waste. Three main factors influence the development and selection of an optimum waste form formulation and hence affect selection of performance criteria. These factors are regulatory, process-specific, and site-specific waste form standards or requirements. Clearly, the optimum waste form formulation will require consideration of performance criteria constraints from each of the three categories. Phase I will focus only on the regulatory criteria. These criteria may be considered the minimum criteria for an acceptable waste form. In other words, a S/S technology is considered viable only if it meet applicable regulatory criteria. The criteria to be utilized in the Phase I treatability studies were primarily taken from Environmental Protection Agency regulations addressed in 40 CFR 260 through 265 and 268; and Nuclear Regulatory Commission regulations addressed in 10 CFR 61. Thus the majority of the identified criteria are independent of waste form matrix composition (i.e., applicable to cement, glass, organic binders etc.).

27381 Waste treatment process for removal of contaminants from aqueous, mixed-waste solutions using sequential chemical treatment and crossflow microfiltration, followed by dewatering. Vijayan, S.; Wong, Chi Fun; Buckley, L.P. To Dept. of Energy. 1992. Filed date 26 Aug 1992. U.S. Patent Application 7-935,328. 27p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. Order Number DE94016106. Source: OSTI; NTIS; INIS; GPO Dep.

It is an object of the claimed invention to combine chemical treatment with microfiltration process to treat groundwater, leachate from contaminated soil washing, surface and run-off waters contaminated with toxic metals, radionuclides and trace amounts of organics from variety of sources. The process can also be used to treat effluents from industrial processes such as discharges associated with smelting, mining and refining operations. Influent contaminants amenable to treatment are from a few mg/L to hundreds of mg/L. By selecting appropriate precipitation, ion exchange and adsorption agents and conditions, efficiencies greater than 99.9 percent can be achieved for removal of contaminants. The filtered water for discharge can be targeted with either an order of magnitude greater or lower than contaminant levels for drinking water.

27382 (PNL–8996) **Evaluation of the potential for gas pressurization and free liquid accumulation in a WVDP canister.** Hazelton, R.F.; Thornhill, C.K. Pacific Northwest Lab., Richland, WA (United States). Dec 1993. 25p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE94014992. Source: OSTI; NTIS; GPO Dep.

A full-scale canister provided by the West Valley Demonstration Project, filled during the SF-11 vitrification qualification test, was tested to determine its potential for gas generation (non-radiolitic only) and liquid accumulation. The canister was sealed and held at a temperature of about 500°C for eight weeks. Gas samples obtained during the test were analyzed using mass spectroscopy to determine the composition of gases within the canister. At the end of the eight weeks the canister gases were evacuated through a desiccant to capture any water that had been released by the glass during the test. In addition, an analysis of the glass using fourier transform infrared spectroscopy was performed to determine the water content in the glass both before and after the temperature exposure.

27383 (PNL–9959) **Mitigation of tank 241-SY-101 by pump mixing: Results of full-scale testing.** Stewart, C.W. (and others); Hudson, J.D.; Friley, J.R.; Panisko, F.E.; Antoniak, Z.I.; Irwin, J.J.; Fadeff, J.G.; Efferding, L.F.; Michener, T.E.; Kirch, N.W. Pacific Northwest Lab., Richland, WA (United States). Jun 1994. 99p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE94016420. Source: OSTI; NTIS; INIS; GPO Dep.

The Full-Scale Mixer Pump Test Program was performed in Hanford Tank 241-SY-101 from February 4 to April 13, 1994, to confirm the long-term operational strategy for flammable gas mitigation and to demonstrate that mixing can control the gas release and waste level. Since its installation on July 3, 1993, the current pump, operating only a few hours per week, has proved capable of mixing the waste sufficiently to release gas continuously instead of in large episodic events. The results of Full-Scale Testing demonstrated that the pump can control gas release and waste level for long-term mitigation, and the four test sequences formed the basis for the long-term operating schedule. The last test sequence, jet penetration tests, showed that the current pump jet creates flow near the tank wall and that it can excavate portions of the bottom sludge layer if run at maximum power. Pump mixing has altered the 'normal' configuration of the waste; most of the original nonconvective sludge has been mixed with the supernatant liquid into a mobile convective slurry that has since been maintained by gentle pump operation and does not readily return to sludge.

27384 (PNL–9984) **Laboratory development of sludge washing and alkaline leaching processes: Test plan for FY 1994.** Rapko, B.M.; Lumetta, G.J. Pacific Northwest Lab., Richland, WA (United States). Jul 1994. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE94016418. Source: OSTI; NTIS; INIS; GPO Dep.

The US Department of Energy plans to vitrify (as borosilicate glass) the large volumes of high-level radioactive wastes at the Hanford site. To reduce costs, pretreatment processes will be used to reduce the volume of borosilicate glass required for disposal. Several options are being considered for the pretreatment processes: (1) sludge washing with water or dilute hydroxide: designed to remove most of the Na from the sludge, thus significantly reducing the volume of waste to be vitrified; (2) sludge washing plus caustic leaching and/or metathesis (alkaline sludge leaching): designed to dissolve large quantities of certain nonradioactive elements, such as Al, Cr and P, thus reducing the volume of waste even more; (3) sludge washing, sludge dissolution, and separation of radionuclides from the dissolved sludge solutions (advanced processing): designed to remove all radionuclides for concentration into a minimum waste volume. This report describes a test plan for work that will be performed in FY 1994 under the Sludge Washing and Caustic Leaching Studies Task (WBS 0402) of the Tank Waste Remediation System (TWRS) Pretreatment Project. The objectives of the work described here are to determine the effects of sludge washing and alkaline leaching on sludge composition and the physical properties of the washed sludge and to evaluate alkaline leaching methods for their impact on the volume of borosilicate glass required to dispose of certain Hanford tank sludges.

27385 (PNL-SA–23055) **Application of Macro Material Flow Modeling to regional solid waste planning.** Holter, G.M.; Stapp, D.C.; Shaver, S.R. Pacific Northwest Lab., Richland, WA (United States). Jun 1994. 12p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. (CONF-940632–22: Annual meeting and exhibition of the Air and Waste Management Association, Cincinnati, OH (United States), 19-24

Jun 1994). Order Number DE94014995. Source: OSTI; NTIS; GPO Dep.

A prototype Macro Material Flow Model (MMFM) is being developed at PNL to analyze various solid waste management options. This model is a macro-level simulation of the entering that system, also through the associated materials production and use system. Within the model, the various major sectors of the economy are modeled separately, taking into account the interconnections among the sectors, and the sectors are further subdivided into the different functions that results in the generation of solid wastes. The model is expected to be useful in evaluating longer-term, broader-ranging impact than are traditionally evaluated by decision-makers involved in implementing solutions to local or regional solid waste management problems. The MMFM provides a predictive capability that can be used as the basis for evaluating potential impacts from various operating scenarios for a solid waste system on a regional level. Inclusion of materials production and use within the modeling context allows a systems approach to be used, providing a much more thorough understanding of the origins of the solid waste materials and also of possible options for materials recovery and reuse than if a more traditional "end-of-pipe" view of solid waste is adopted. It also allows the interaction of the various waste management alternatives to be more clearly understood, to ensure that suitable flexibility is incorporated as recommended into the resulting overall system.

27386 (PNL-SA-23186) **NEPA implementation: The Department of Energy's program to manage spent nuclear fuel.** Shipler, D.B. Pacific Northwest Lab., Richland, WA (United States). May 1994. 18p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. (CONF-940553–70: International high-level radioactive waste management conference, Las Vegas, NV (United States), 22-26 May 1994). Order Number DE94014558. Source: OSTI; NTIS; INIS; GPO Dep.

The Department of Energy (DOE) is implementing the National Environmental Protection Act (NEPA) in its management of spent nuclear fuel. The DOE strategy is to address the short-term safety concerns about existing spent nuclear fuel, to study alternatives for interim storage, and to develop a long-range program to manage spent nuclear fuel. This paper discusses the NEPA process, the environmental impact statements for specific sites as well as the overall program, the inventory of DOE spent nuclear fuel, the alternatives for managing the fuel, and the schedule for implementing the program.

27387 (PNL-SA-23384) **Towards optimization of nuclear waste glass: Constraints, property models, and waste loading.** Hrma, P. Pacific Northwest Lab., Richland, WA (United States). Apr 1994. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. (CONF-940416–21: 96. annual meeting of the American Ceramic Society, Indianapolis, IN (United States), 24-28 Apr 1994). Order Number DE94015286. Source: OSTI; NTIS; INIS; GPO Dep.

Vitrification of both low- and high-level wastes from 177 tanks at Hanford poses a great challenge to glass makers, whose task is to formulate a system of glasses that are acceptable to the federal repository for disposal. The enormous quantity of the waste requires a glass product of the lowest possible volume. The incomplete knowledge of waste composition, its variability, and lack of an appropriate vitrification technology further complicates this difficult task. A simple relationship between the waste loading and the waste glass volume is presented and applied to the predominantly refractory (usually high-activity) and predominantly alkaline (usually low-activity) waste types. Three factors that limit waste loading are discussed, namely product acceptability, melter processing, and model validity. Glass formulation and optimization problems are identified and a broader approach to uncertainties is suggested.

27388 (PNL-SA-23454) **Maximization of waste loading for a vitrified Hanford high-activity simulated waste.** Fini, P.T. (State Univ. of New York, Alfred, NY (United States). Coll. of Ceramics); Hrma, P. Pacific Northwest Lab., Richland, WA (United States). Apr 1994. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. (CONF-940416–23: 96. annual meeting of the American Ceramic Society, Indianapolis, IN (United States), 24-28 Apr 1994). Order Number DE94015273. Source: OSTI; NTIS; INIS; GPO Dep.

Simulated high-level nuclear waste glasses incorporating up to 70 wt % Neutralized Current Acid Waste (NCAW) were prepared. For the waste loading (W) range of 40 to 55 wt %, alkaliborosilicate glasses were formulated with a melting temperature of 1,150 C; for W > 55 wt %, only silica was added to the waste and the melting temperature was 1,150 C. Properties measured included durability and crystallinity of slowly cooled glasses and glasses heat treated for 24 hours at 1,050 C. Acceptable durability (by the Environmental Assessment glass standard) was retained up to W = 70 wt %, which is the maximum NCAW waste loading if no limit on crystallinity is imposed. If < 1 vol% of spinel is acceptable in the melt at 1,050 C, a waste loading of approximately 50 wt % is possible. If no crystallinity is permissible at 1,050 C, W = 34 wt % is the estimated maximum.

27389 (PNL-SA-23487) **The role of frit in nuclear waste vitrification.** Vienna, J.D.; Smith, P.A.; Dorn, D.A.; Hrma, P. Pacific Northwest Lab., Richland, WA (United States). Apr 1994. 16p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. (CONF-940416–22: 96. annual meeting of the American Ceramic Society, Indianapolis, IN (United States), 24-28 Apr 1994). Order Number DE94015212. Source: OSTI; NTIS; INIS; GPO Dep.

Vitrification of nuclear waste requires additives which are often vitrified independently to form a frit. Frit composition is formulated to meet the needs of glass composition and processing. The effects of frit on melter feed and melt processing, glass acceptance, and waste loading is of practical interest in understanding the trade-offs associated with the competing demands placed on frit composition. Melter feed yield stress, viscosity and durability of frits and corresponding waste glasses as well as the kinetics of elementary melting processes have been measured. The results illustrate the competing requirements on frit. Four frits (FY91, FY93, HW39-4, and SR202) and simulated neutralized current acid waste (NCAW) were used in this study. The experimental evidence shows that optimization of frit for one processing related property often results in poorer performance for the remaining properties. The difficulties associated with maximum waste loading and durability are elucidated for glasses which could be processed using technology available for the previously proposed Hanford Waste Vitrification Plant.

27390 (PNL-SA-23488) **Predicting liquid immiscibility in multicomponent nuclear waste glasses.** Peeler, D.K.; Hrma, P.R. Pacific Northwest Lab., Richland, WA (United States). Apr 1994. 12p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. (CONF-940416–17: 96. annual meeting of the American Ceramic Society, Indianapolis, IN (United States), 24-28 Apr 1994). Order Number DE94014571. Source: OSTI; NTIS; INIS; GPO Dep.

Taylor's model for predicting amorphous phase separation in complex, multicomponent systems has been applied to high-level (simulated) radioactive waste glasses at the US Department of Energy's Hanford site. Taylor's model is primarily based on additions of modifying cations to a Na_2O-B_2O_3-SiO_2 (NBS) submixture of the multicomponent glass. The position of the submixture relative to the miscibility dome defines the development probability of amorphous phase separation. Although prediction of amorphous phase separation in Hanford glasses (via experimental SEM/TEM analysis) is the primary thrust of this work; reported durability data is also provides limited insight into the composition/durability relationship. Using a modified model similar to Taylor's, the results indicate that immiscibility may be predicted for multicomponent waste glasses by the addition of Li_2O to the "alkali" corner of the NBS submixture.

27391 (PNL-SA-24065) **Potential gas releases from the bottom sludge layer.** Stewart, C.W. Pacific Northwest Lab., Richland, WA (United States). Apr 1994. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. (CONF-9404186–1: Tank waste chemical reactions meeting, Richland, WA (United States), 11 Apr 1994). Order Number DE94014498. Source: OSTI; NTIS; INIS; GPO Dep.

A layer of sludge about 50 inches deep may exist at the bottom of the tank that has not been mixed by the pump. This bottom

sludge layer may be accumulating gas at a rate of 23 SCF/day, resulting in a basal level rise of 0.025 inches/day. At some point sufficient gas may accumulate to release spontaneously. Using reasonable assumptions about gas generation, waste properties and the mechanics of the release process, this may result in gas releases on the order of 1, 000 SCF.

27392 (PNL-SA–24210) **Pollution prevention training for facility designers.** Dorsey, J.A. (Pacific Northwest Lab., Richland, WA (United States)); Raney, E.A.; Whitehead, J.K. Pacific Northwest Lab., Richland, WA (United States). May 1994. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. (CONF-940578–10: Pollution prevention conference, Denver, CO (United States), 3-5 May 1994). Order Number DE94014437. Source: OSTI; NTIS; GPO Dep.

An Orientation to Pollution Prevention for Facility Design training course was developed for the US Department of Energy (DOE), Office of Environmental Restoration and Waste Management, Waste Minimization Division. The 3-hour course will be offered at the Hanford Quality Training and Resource Center beginning Summer, 1994. The course, intended for design engineers and project managers, contains two modules. The first module defines pollution prevention using actual success stories to illustrate pollution prevention concepts, benefits, and their relationship to design. The second module presents a newly developed job aid, the Pollution Prevention Design Guideline. The main challenges of developing the course were to present the material in a manner that participants would want to design for pollution prevention, and provide tools so that participants could design for pollution prevention. As such, the course is very interactive and uses a variety of presentation techniques. Participants are challenged to discuss the course materials in the context of their own design projects, and they practice using their new knowledge on an actual design project. The biggest measure of the course's success is the extent to which the participants bring the materials back to their work place. An attitudinal survey and a knowledge-based questionnaire are administered before and after the course in order to gage this.

27393 (SAND–93-0681) **Sandia National Laboratories site-wide hydrogeologic characterization project calendar year 1992 annual report.** Crowson, D. (and others); Gibson, J.D.; Haase, C.S.; Holt, R.; Hyndman, D.; Krumhansl, J.; Lauffer, F.; McCord, J.P.; McCord, J.T.; Neel, D. Sandia National Labs., Albuquerque, NM (United States). Oct 1993. 185p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. Order Number DE94015597. Source: OSTI; NTIS; GPO Dep.

The Sandia National Laboratories, New Mexico (SNL/NM) Site-Wide Hydrogeologic Characterization (SWHC) project has been implemented as part of the SNL/NM Environmental Restoration (ER) Program to develop the regional hydrogeologic framework and baseline for the approximately 100 mi of Kirtland Air Force Base (KAFB) and adjacent withdrawn public lands upon which SNL/NM has performed research and development activities. Additionally, the SWHC project will investigate and characterize generic hydrogeologic issues associated with the 172 ER sites owned by SNL/NM across its facilities on KAFB. As called for in the Hazardous and Solid Waste Amendments (HSWA) to the Resource Conservation and Recovery Act (RCRA) Part B permit agreement between the U.S. Environmental Protection Agency (EPA) as the permitter and the U.S. Department of Energy (DOE) and SNL/NM as the permittees, an annual report is to be prepared by the SWHC project team. This document serves two primary purposes: (1) to identify and describe the conceptual framework for the hydrogeologic system underlying SNL/NM and (2) to describe characterization activities undertaken in the preceding year that add to our understanding (reduce our uncertainties) regarding the conceptual and quantitative hydrogeologic framework. This SWHC project annual report focuses primarily on purpose 1, providing a summary description of the current "state of knowledge" of the Sandia National Laboratories/Kirtland Air Force Base (SNL/KAFB) hydrogeologic setting.

27394 (SAND–94-0482C) **Scenario development for the Waste Isolation Pilot Plant: Building confidence in the assessment.** Galson, D.A. (Galson Sciences Limited, (United Kingdom)); Swift, P.N. Sandia National Labs., Albuquerque, NM (United States). [1994]. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. (CONF-940553–16: International high-level radioactive waste management conference, Las Vegas, NV (United States), 22-26 May 1994). Order Number DE94007933. Source: OSTI; NTIS; INIS; GPO Dep.

Scenario developments is part of the iterative performance assessment (PA) process for the Waste Isolation Pilot Plant (WIPP). Scenario development for the WIPP has been the subject of intense external review, and is certain to be the subject of continued scrutiny as the project proceeds toward regulatory compliance. The principal means of increasing confidence is this aspect of the PA will be through the use of a systematic and thorough procedure toward developing the scenarios and conceptual models on which the assessment is to be based. Early and ongoing interaction with project reviewers can assist with confidence building. Quality of argument and clarity of presentation in PA will be of key concern. Appropriate tools are required for documenting and tracking assumptions, through a single assessment phase, and between iterative assessment phases. Risks associated with future human actions are of particular concern to the WIPP project, and international consensus on the principles for incorporation of future human actions in assessments would be valuable.

27395 (SAND–94-8002) **Process Waste Assessment for the Plotting and Digitizing Support Laboratory.** Phillips, N.M. Sandia National Labs., Livermore, CA (United States). Apr 1994. 14p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DR00789. Order Number DE94011627. Source: OSTI; NTIS; INIS; GPO Dep.

This Process Waste Assessment was conducted to evaluate the Plotting and Digitizing Support Laboratory, located in Building 913, Room 157. It documents the processes, identifies the hazardous chemical waste streams generated by these processes, recommends possible ways to minimize waste, and serves as a reference for future assessments of this facility.

27396 (SD-WM-TI–131) **Recommended technical specifications for first generation test surface and subsurface markers.** Adams, M.R. Rockwell International Corp., Richland, WA (United States). Rockwell Hanford Operations. 24 Apr 1984. 16p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE94016432. Source: OSTI; NTIS; GPO Dep.

Federal regulations and Rockwell Hanford Operations (Rockwell) planning documents require that radioactive waste sites disposed in-place be permanently marked. A number of technical studies have addressed the materials to be used for permanent markers as well as the design configurations. Criteria and standards for markers have also been prepared and issued in draft form. The next step in marker development requires laboratory and field testing of prototype markers. This document provides design specifications for the first generation surface and subsurface markers. At the conclusion of testing activities, definitive specifications can be prepared. Included herein are specifications for marker placement, marker materials, marker configuration and dimensions and marker messages. This document presents specifications only and does not provide rationale or justification for the specifications. Such rationale and justification is available in referenced documents.

27397 (SD-WM-TP–30) **Subsurface marker emplacement test plan.** Adams, M.R.; Carlson, R.A. Rockwell International Corp., Richland, WA (United States). Rockwell Hanford Operations. 30 May 1986. 12p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE94016433. Source: OSTI; NTIS; GPO Dep.

Current plans propose placing subsurface markers within protective barriers to deter potential human intrusion into disposed radioactive wastes. The subsurface markers would provide warning to the digging intruder should surface markers be removed, destroyed, or ignored. This plan sets forth procedures for testing the survivability of the subsurface markers during construction of the barrier. After the tests described herein are concluded, a decision can be made as to whether subsurface markers will require protection during barrier construction. If protection is required, additional tests will be needed to test the effectiveness of various protective approaches.

27398 (SR/H–695) **S-E-Co. Radwaste Disposal Systems, Bridge Crane, Model No. 2107; Decanting Station, Model No. 2207; Drumming Station, Model No. 2307; Compactor, Model No. 2407.** Stock, A.J. (Stock Equipment Company, Chagrin Falls, OH (United States)). Du Pont de Nemours (E.I.) and Co., Aiken, SC (United States). Savannah River Plant. Sep 1975. 92p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-76SR00001. Order Number DE94009151. Source: OSTI; NTIS (US Sales Only); GPO Dep.

Engineering drawings for this project are identified as CAPE-3077. Inquiries may be directed to: Office of Scientific and Technical Information, P.O. Box 62, Oak Ridge, TN 37831.

The Solid Radwaste System designed and manufactured by Stock Equipment company (S-E-Co.) is a completely integrated system. The design is based primarily on four principles considered essential to equipment for nuclear power stations: maximum reliability, minimum maintenance, maximum safety to personnel, forty-year life. In order to achieve these standards, the S-E-Co. System utilizes components which are designed specifically for the service expected rather than attempting to modify standard equipment. The S-E-Co. design uses cement as a solidification agent and packages the solid radwaste into 55-gallon drums. The S-E-Co. System is also easily adaptable to other types of solidification agents such as urea formaldehyde. Components of the System are cement filling station, decanting station, drumming station, bridge crane, control console, drum inspection and labeling station, and dry waste compactor.

27399 (STUK/YVL-GUIDE–8.2) **Exemption from regulatory control of nuclear wastes.** Finnish Centre for Radiation and Nuclear Safety (STUK), Helsinki (Finland). 1992. 7p. Translation of the original text in Finnish which is published under the same guide number. Order Number DE94632827. Source: OSTI; NTIS; INIS.

The guide is valid from 1.5.1992 and will remain in force until further notice. It replaces the guide YVL 8.2 issued on 1.7.1985.

The guide specifies the principles and criteria for the exemption of the low-level radioactive wastes for disposal, reuse or recycle. The basic radiation protection criteria are consistent with those given in the IAEA Safety Series No. 89. The guide allows two options for exemption: unrestricted or restricted. Unrestricted exemption is possible if the waste meets fairly strict activity levels. In case of restricted exemption, the receiver and further treatment of disposal of waste must be adequately specified and the compliance with radiation protection criteria must be analyzed. Some guidance on the methods for monitoring the activity in waste is also given. (5 refs.).

27400 (UCRL–21215-94-Rev.1) **Waste minimization and pollution prevention awareness plan: Revision 1.** Lawrence Livermore National Lab., CA (United States). Jul 1994. 194p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. Order Number DE94015872. Source: OSTI; NTIS; INIS; GPO Dep.

The purpose of this plan is to document Lawrence Livermore National Laboratory (LLNL) projections for present and future waste minimization and pollution prevention. The plan specifies those activities and methods that are or will be used to reduce the quantity and toxicity of wastes generated at the site. It is intended to satisfy Department of Energy (DOE) requirements. This Waste Minimization and Pollution Prevention Awareness Plan provides an overview of projected activities from FY 1994 through FY 1999. The plans are broken into site-wide and problem-specific activities. All directorates at LLNL have had an opportunity to contribute input, estimate budgets, and review the plan. In addition to the above, this plan records LLNL's goals for pollution prevention, regulatory drivers for those activities, assumptions on which the cost estimates are based, analyses of the strengths of the projects, and the barriers to increasing pollution prevention activities.

27401 (UCRL-ID–115754) **Mixed Waste Treatment Project: Computer simulations of integrated flowsheets.** Dietsche, L.J. Lawrence Livermore National Lab., CA (United States). Dec 1993. 32p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. Order Number DE94012587. Source: OSTI; NTIS; INIS; GPO Dep.

The disposal of mixed waste, that is waste containing both hazardous and radioactive components, is a challenging waste management problem of particular concern to DOE sites throughout the United States. Traditional technologies used for the destruction of hazardous wastes need to be re-evaluated for their ability to handle mixed wastes, and in some cases new technologies need to be developed. The Mixed Waste Treatment Project (MWTP) was set up by DOE's Waste Operations Program (EM30) to provide guidance on mixed waste treatment options. One of MWTP's charters is to develop flowsheets for prototype integrated mixed waste treatment facilities which can serve as models for sites developing their own treatment strategies. Evaluation of these flowsheets is being facilitated through the use of computer modelling. The objective of the flowsheet simulations is to provide mass and energy balances, product compositions, and equipment sizing (leading to cost) information. The modelled flowsheets need to be easily modified to examine how alternative technologies and varying feed streams effect the overall integrated process. One such commercially available simulation program is ASPEN PLUS. This report contains details of the Aspen Plus program.

27402 (UCRL-ID–117011) **Summary of LLNL's accomplishments for the FY93 Waste Processing Operations Program.** Grasz, E.; Domning, E.; Heggins, D.; Huber, L.; Hurd, R.; Martz, H.; Roberson, P.; Wilhelmsen, K. Lawrence Livermore National Lab., CA (United States). Apr 1994. 40p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. Order Number DE94015879. Source: OSTI; NTIS; INIS; GPO Dep.

Under the US Department of Energy's (DOE's) Office of Technology Development (OTD)-Robotic Technology Development Program (RTDP), the Waste Processing Operations (WPO) Program was initiated in FY92 to address the development of automated material handling and automated chemical and physical processing systems for mixed wastes. The Program's mission was to develop a strategy for the treatment of all DOE mixed, low-level, and transuranic wastes. As part of this mission, DOE's Mixed Waste Integrated Program (MWIP) was charged with the development of innovative waste treatment technologies to surmount shortcomings of existing baseline systems. Current technology advancements and applications results from cooperation of private industry, educational institutions, and several national laboratories operated for DOE. This summary document presents the LLNL Environmental Restoration and Waste Management (ER and WM) Automation and Robotics Section's contributions in support of DOE's FY93 WPO Program. This document further describes the technological developments that were integrated in the 1993 Mixed Waste Operations (MWO) Demonstration held at SRTC in November 1993.

27403 (UCRL-JC–114776) **The testing of thermal-mechanical-hydrological-chemical processes using a large block.** Lin, W.; Wilder, D.G.; Blink, J.A.; Blair, S.C.; Buscheck, T.A.; Chesnut, D.A.; Glassley, W.E.; Lee, K.; Roberts, J.J. Lawrence Livermore National Lab., CA (United States). Jan 1994. 13p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-940553–22: International high-level radioactive waste management conference, Las Vegas, NV (United States), 22-26 May 1994). Order Number DE94008966. Source: OSTI; NTIS; INIS; GPO Dep.

The radioactive decay heat from nuclear waste packages may, depending on the thermal load, create coupled thermal-mechanical-hydrological-chemical (TMHC) processes in the near-field environment of a repository. A group of tests on a large block (LBT) are planned to provide a timely opportunity to test and calibrate some of the TMHC model concepts. The LBT is advantageous for testing and verifying model concepts because the boundary conditions are controlled, and the block can be characterized before and after the experiment. A block of Topopah Spring tuff of about 3 x 3 x 4.5 m will be sawed and isolated at Fran Ridge, Nevada Test Site. Small blocks of the rock adjacent to the large block will be collected for laboratory testing of some individual thermal-mechanical, hydrological, and chemical processes. A constant load of about 4 MPa will be applied to the top and sides of the large block. The sides will be sealed with moisture and thermal barriers. The large block will be heated with one heater in each borehole

and guard heaters on the sides so that a dry-out zone and a condensate zone will exist simultaneously. Temperature, moisture content, pore pressure, chemical composition, stress and displacement will be measured throughout the block during the heating and cool-down phases. The results from the experiments on small blocks and the tests on the large block will provide a better understanding of some concepts of the coupled TMHC processes.

27404 (UCRL-JC–116350) **Limitations on scientific prediction and how they could affect repository licensing.** Van Konynenburg, R.A. Lawrence Livermore National Lab., CA (United States). Jan 1994. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-940553–74: International high-level radioactive waste management conference, Las Vegas, NV (United States), 22-26 May 1994). Order Number DE94014788. Source: OSTI; NTIS; INIS; GPO Dep.

The best possibility for gaining an understanding of the likely future behavior of a high level nuclear waste disposal system is to use the scientific method. However, the scientific approach has inherent limitations when it comes to making long-term predictions with confidence. This paper examines some of these limiting factors as well as the criteria for admissibility of scientific evidence in the legal arena, and concludes that the prospects are doubtful for successful licensing of a potential repository under the regulations that are now being reconsidered. Suggestions am made for remedying this situation.

27405 (USGS-OFR–94-54) **Selected ground-water data for Yucca Mountain Region, southern Nevada and eastern California, through December 22.** La Camera, R.J.; Westenburg, C.L. USDOE Nevada Operations Office, Las Vegas, NV (United States). 1994. 169p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AI08-92NV10874. Order Number DE94017061. Source: OSTI; NTIS; INIS; GPO Dep.

The U.S. Geological Survey, in support of the U.S. Department of Energy, Yucca Mountain Site-Characterization Project, collects, compiles, and summarizes hydrologic data in the Yucca Mountain region. The data are collected to allow assessments of groundwater resources during studies to determine the potential suitability of Yucca Mountain for storing high-level nuclear waste. Data on ground-water levels at 36 sites, ground-water discharge at 6 sites, ground-water quality at 19 sites, and ground-water withdrawals within Crater Flat, Jackass Flats, Mercury Valley, and the Amargosa Desert are presented. Data on ground-water levels, discharges, and withdrawals collected by other agencies (or as part of other programs) are included to further indicate variations through time at selected monitoring locations. Data are included in this report from 1910 through 1992.

27406 (USGS-WRI–93-4144) **Pore-water extraction from unsaturated tuff by triaxial and one-dimensional compression methods, Nevada Test Site, Nevada.** Mower, T.E. (PRC Environmental Management, Inc., Denver, CO (United States)); Higgins, J.D.; Yang, In C.; Peters, C.A. Geological Survey, Denver, CO (United States). 1994. 78p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AI08-92NV10874. Order Number DE94015008. Source: OSTI; NTIS; INIS; GPO Dep.

The hydrologic system in the unsaturated tuff at Yucca Mountain, Nevada, is being evaluated for the US Department of Energy by the Yucca Mountain Project Branch of the US Geological Survey as a potential site for a high-level radioactive-waste repository. Part of this investigation includes a hydrochemical study that is being made to assess characteristics of the hydrologic system such as: traveltime, direction of flow, recharge and source relations, and types and magnitudes of chemical reactions in the unsaturated tuff. In addition, this hydrochemical information will be used in the study of the dispersive and corrosive effects of unsaturated-zone water on the radioactive-waste storage canisters. This report describes the design and validation of laboratory experimental procedures for extracting representative samples of uncontaminated pore water from welded and nonwelded, unsaturated tuffs from the Nevada Test Site.

27407 (WHC-EP–0474-13) **Quarterly report on the Ferrocyanide Safety Program for the period ending June 30, 1994.** Meacham, J.E.; Cash, R.J.; Dukelow, G.T. Westinghouse Hanford Co., Richland, WA (United States). Jul 1994. 84p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE94016463. Source: OSTI; NTIS; GPO Dep.

This is the thirteenth quarterly report on the progress of activities addressing the Ferrocyanide Safety Issue associated With Hanford site high-level radioactive waste tanks. Progress in the Ferrocyanide Safety Program is reviewed, including work addressing the six parts of Defense Nuclear Facilities Safety Board Recommendation 90-7 (FR 1990). All work activities are described in the revised program plan (Borsheim et al. 1993), and this report follows the same format presented there. A summary of the key events occurring this quarter is presented in Section 1.2. More detailed discussions of progress are located in Sections 3.0 and 4.0.

27408 (WHC-EP–0711) **Summary of information on flammable gas watch list tanks.** Brager, H.R. Westinghouse Hanford Co., Richland, WA (United States). Jan 1994. 712p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE94016479. Source: OSTI; NTIS; GPO Dep.

This document compiles and summarizes available, relevant information pertaining to Hanford Site waste tanks designated as Flammable Gas Watch List (FGWL) tanks. There are four primary objectives of this document. First, it provides summary data, including surface level readings, chemical composition, and temperature readings for each FGWL tank. This document also is intended to be used as a source of information on FGWL tanks references. More than 400 documents were used to compile the information presented in this report, and the Endnotes at the conclusion of each section; Section 5.0, "References;" and Section 6.0, "Sources of Information" are all included to direct the reader to further, more detailed sources of information that pertain to specific FGWL tanks or information. The third objective of this document is to present the specific fill history of each FGWL double-shell tank (DST), including data obtained from detailed Evaporator 242-A documents. Finally, this document includes an assessment of the total organic carbon (TOC) content of each DST.

27409 (WHC-EP–0729) **Ferrocyanide safety program: Thermal analysis of ferrocyanide tanks, Group I.** McLaren, J.M. Westinghouse Hanford Co., Richland, WA (United States). Jun 1994. 80p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE94016478. Source: OSTI; NTIS; INIS; GPO Dep.

The purpose of this report is to document the results of a series of analyses conducted to the heat loads of the first of two groups of tanks on the Ferrocyanide Watch List. The analyses use the fill/transfer history with a transient solution for the heat load determination. Nominal values of the heat load are determined, as well as the upper lower bounds of the heat load. Ranges of thermal conductivity of the tank waste are determined.

27410 (WHC-EP–0767-Rev.1) **Westinghouse Hanford Company Codes and Standards Compliance Program: Fiscal Year 1994 Work Plan: Revision 1.** Moist, S.L. Westinghouse Hanford Co., Richland, WA (United States). May 1994. 14p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE94014632. Source: OSTI; NTIS; GPO Dep.

This FY Work Plan (FYWP) applies to facilities at the Hanford Site under the management of WHC and the Hanford site S/RID. Project management plans will be developed for each facility/activity to document the specific technical and administrative controls for S/RID development and S/R implementation assessments.

27411 (WHC-EP–0769) **Task E container corrosion studies: Annual report.** Bunnell, L.R. (Pacific Northwest Lab., Richland, WA (United States)); Doremus, L.A.; Topping, J.B.; Duncan, D.R. Westinghouse Hanford Co., Richland, WA (United States). Jun 1994. 50p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE94015661. Source: OSTI; NTIS; INIS; GPO Dep.

The Pacific Northwest Laboratory is conducting the Solid Waste Technology Support Program (SWTSP) for Westinghouse Hanford Company (WHC). Task E is the Container Corrosion Study Portion

of the SWTSP that will perform testing to provide defensible data on the corrosion of low-carbon steel, as used in drums to contain chemical and radioactive wastes at the Hanford Site. A second objective of Task E is to provide and test practical alternative materials that have higher corrosion resistance than low-carbon steel. The scope of work for fiscal year (FY) 1993 included initial testing of mild steel specimens buried in Hanford soils or exposed to atmospheric corrosion in metal storage sheds. During FY 1993, progress was made in three areas of Task E. First, exposure of test materials began at the Soil Corrosion Test Site where low-carbon steel specimens were placed in the soil in five test shafts at depths of 9 m (30 ft). Second, the corrosion measurement of low-carbon steel in the soil of two solid waste trenches continued. The total exposure time is ≈ 500 days. Third, an atmospheric corrosion test of low-carbon steel was put initiated in a metal shed (Building 2401-W) in the 200 West Area. This annual report describes the Task E efforts and provides a current status.

27412 (WHC-EP–0780) **Vapor characterization of Tank 241-C-103.** Huckaby, J.L. (Westinghouse Hanford Co., Richland, WA (United States)); Story, M.S. Westinghouse Hanford Co., Richland, WA (United States). Jun 1994. 82p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE94016458. Source: OSTI; NTIS; INIS; GPO Dep.

The Westinghouse Hanford Company Tank Vapor Issue Resolution Program has developed, in cooperation with Northwest Instrument Systems, Inc., Oak Ridge National Laboratory, Oregon Graduate Institute of Science and Technology, Pacific Northwest Laboratory, and Sandia National Laboratory, the equipment and expertise to characterize gases and vapors in the high-level radioactive waste storage tanks at the Hanford Site in south central Washington State. This capability has been demonstrated by the characterization of the tank 241-C-103 headspace. This tank headspace is the first, and for many reasons is expected to be the most problematic, that will be characterized (Osborne 1992). Results from the most recent and comprehensive sampling event, sample job 7B, are presented for the purpose of providing scientific bases for resolution of vapor issues associated with tank 241-C-103. This report is based on the work of Clauss et al. 1994, Jenkins et al. 1994, Ligotke et al. 1994, Mahon et al. 1994, and Rasmussen and Einfeld 1994. No attempt has been made in this report to evaluate the implications of the data presented, such as the potential impact of headspace gases and vapors to tank farm workers health. That and other issues will be addressed elsewhere. Key to the resolution of worker health issues is the quantitation of compounds of toxicological concern. The Toxicology Review Panel, a panel of Pacific Northwest Laboratory experts in various areas, of toxicology, has chosen 19 previously identified compounds as being of potential toxicological concern. During sample job 7B, the sampling and analytical methodology was validated for this preliminary list of compounds of toxicological concern. Validation was performed according to guidance provided by the Tank Vapor Conference Committee, a group of analytical chemists from academic institutions and national laboratories assembled and commissioned by the Tank Vapor Issue Resolution Program.

27413 (WHC-EP–0784) **Tank exhaust comparison with 40 CFR 61.93, Subpart H, and other referenced guidelines for Tank Farms National Emission Standards for Hazardous Air Pollutant (NESHAP) designated stacks.** Bachand, D.D.; Crummel, G.M. Westinghouse Hanford Co., Richland, WA (United States). Jul 1994. 200p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE94016470. Source: OSTI; NTIS; INIS; GPO Dep.

The US Environmental Protection Agency (EPA) promulgated National Emission Standards other than Radon from US Department of Energy (DOE) Facilities (40 CFR 61, Subpart H) on December 15, 1989. The regulations specify procedures, equipment, and test methods that.are to be used to measure radionuclide emissions from exhaust stacks that are designated as National Emission Standards for Hazardous Air Pollutant (NESHAP) stacks. Designated NESHAP stacks are those that have the potential to cause any member of the public to receive an effective dose equivalent (EDE) greater than or equal to 0.1 mrem/year, assuming all emission controls were removed. Tank Farms currently has 33 exhaust stacks, 15 of which are designated NESHAP stacks. This document assesses the compliance status of the monitoring and sampling systems for the designated NESHAP stacks.

27414 (WHC-MR–0463) **Training plan for the 1164 <90-day non-radioactive hazardous waste storage building.** Demarest, J.L. Westinghouse Hanford Co., Richland, WA (United States). Jun 1994. 17p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE94015332. Source: OSTI; NTIS; GPO Dep.

In accordance with Washington Administrative Code (WAC), Chapter 173–303, "Dangerous Waste Regulations," a written training plan is required for a <90-day accumulation area. WAC 173-303-200, "Accumulating Dangerous Waste on-site" requires compliance with WAC 173-303-330, Personnel Training. This training plan complies with WAC 173-303-330. This training plan, including the names of personnel in Table 1, may be given to a regulatory agency inspector upon request provided that this plan is cleared for public release. Training records associated with personnel identified in this plan are not to be given to an outside regulatory agency inspector unless prior approval by the specific individual is obtained. Training records requests by regulatory agency inspectors without the individual's approval are to be processed via a Freedom of Information Act request through the US Department of Energy, Richland Field Office.

27415 (WHC-SA–2016) **Structural design and analysis of the multi-function waste tanks.** Farnworth, S.K. (Westinghouse Hanford Co., Richland, WA (United States)); Stine, M.D.; Miller, L.K. Westinghouse Hanford Co., Richland, WA (United States). Oct 1993. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-9310102–46: 4. energy natural phenomena hazards mitigation conference, Atlanta, GA (United States), 19-22 Oct 1993). Order Number DE94015755. Source: OSTI; NTIS; INIS; GPO Dep.

This paper describes structural design and analysis procedures to be used for the Multi-function Waste Tank Facility underground waste storage tanks proposed for the Hanford Site. The Multi-function Waste Tank Facility will consist of four one-million-gallon nominal capacity, double-shell, underground waste storage tanks and will include the associated process and control systems and aboveground structures. The tanks will consist of an inner primary steel tank and an outer secondary reinforced-concrete steel-lined tank. The primary tank head will be structurally attached to the concrete dome. A supporting layer of material will be placed between the bottom of the primary steel tank and the bottom of the steel liner on the secondary tank. The tank analysis is undertaken jointly by a team of engineers and analysts representing Kaiser Engineers Hanford, the site architect/engineer, and Westinghouse Hanford Company, the site management and operating contractor. This analysis is planned in several phases. Heat transfer solutions will address the anticipated mixing pump and cyclic fill/drain environment to provide steel and concrete temperature distributions. With this information, an in situ static analysis of the reinforced-concrete secondary tank will be carried out over the structure design life and will give material states and deformations along with strength and stability checks. Seismic analysis, accounting for soil-structure interaction and liquid loads, will be conducted with the most conservative material state, and the in situ deformations will be incorporated. Finally, penetrations and other components will be analyzed.

27416 (WHC-SA–2317) **Liquid return from gas pressurization of grouted waste.** Powell, W.J.; Benny, H.L. Westinghouse Hanford Co., Richland, WA (United States). May 1994. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-940815–69: International nuclear and hazardous waste management conference, Atlanta, GA (United States), 14-18 Aug 1994). Order Number DE94015707. Source: OSTI; NTIS; INIS; GPO Dep.

The ability to force pore liquids out of a simulated waste grout matrix using air pressure was measured. Specimens cured under various conditions were placed in a permeameter and subjected to increasing air pressure. The pressure was held constant for 24 hours and then stepped up until either liquid was released or 150 psi was reached. One specimen was taken to 190 psi with no

liquid release. Permeability to simulated tank waste was then measured. Compressive strength was measured following these tests. This data is to assess the amount of fluid that might be released from grouted waste resulting from the buildup of radiolytically generated hydrogen and other gasses within the waste form matrix. A plot of the unconfined compressive strength versus breakthrough pressures identifies a region of "good" grout, which will resist liquid release.

27417 (WHC-SA–2335) **The Hanford site tank waste remediation system technical strategy.** Wodrich, D.D. Westinghouse Hanford Co., Richland, WA (United States). Apr 1994. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-940815–56: International nuclear and hazardous waste management conference, Atlanta, GA (United States), 14-18 Aug 1994). Order Number DE94014629. Source: OSTI; NTIS; INIS; GPO Dep.

The US Department of Energy's Hanford Site, located in southeastern Washington State, has the most diverse and largest amount of radioactive tank the United States. High-level radioactive waste has been stored in large underground tanks since 1944. Approximately 230,000 m^3 (61 Mgal) of caustic liquids, slurries, saltcakes, and sludges have accumulated in 177 tanks. In addition, significant amounts of ^{90}S and ^{137}Cs were removed from the tank waste, converted to salts, doubly encapsulated in metal containers, and stored in water basins. A Tank Waste Remediation System Program was established by the US DOE Energy in 1991 to safely manage and immobilize these wastes for permanent disposal of the high-level waste fraction in a geologic repository. The technical strategy to manage and dispose of these wastes has been revised and successfully negotiated with the regulatory agencies.

27418 (WHC-SA–2413) **The role of Quality Oversight in nuclear and hazardous waste management and environmental restoration at Westinghouse Hanford Company.** Fouad, H.Y. Westinghouse Hanford Co., Richland, WA (United States). May 1994. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-940815–52: International nuclear and hazardous waste management conference, Atlanta, GA (United States), 14-18 Aug 1994). Order Number DE94014637. Source: OSTI; NTIS; INIS; GPO Dep.

The historical factors that led to the waste at Hanford are outlined. Westinghouse Hanford Company mission and organization are described. The role of the Quality Oversight organization in nuclear hazardous waste management and environmental restoration at Westinghouse Hanford Company is delineated. Tank Waste Remediation Systems activities and the role of the Quality Oversight organization are described as they apply to typical projects. Quality Oversight's role as the foundation for implementation of systems engineering and operation research principles is pointed out.

27419 (WHC-SA–2433) **Determination of total cyanide in Hanford Site high-level wastes.** Winters, W.I. (Westinghouse Hanford Co., Richland, WA (United States)); Pool, K.H. Westinghouse Hanford Co., Richland, WA (United States). May 1994. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-940815–53: International nuclear and hazardous waste management conference, Atlanta, GA (United States), 14-18 Aug 1994). Order Number DE94014636. Source: OSTI; NTIS; INIS; GPO Dep.

Nickel ferrocyanide compounds ($Na_{2-x}Cs_xNiFe(CN)_6$) were produced in a scavenging process to remove ^{137}Cs from Hanford Site single-shell tank waste supernates. Methods for determining total cyanide in Hanford Site high-level wastes are needed for the evaluation of potential exothermic reactions between cyanide and oxidizers such as nitrate and for safe storage, processing, and management of the wastes in compliance with regulatory requirements. Hanford Site laboratory experience in determining cyanide in high-level wastes is summarized. Modifications were made to standard cyanide methods to permit improved handling of high-level waste samples and to eliminate interferences found in Hanford Site waste matrices. Interferences and associated procedure modifications caused by high nitrates/nitrite concentrations, insoluble nickel ferrocyanides, and organic complexants are described.

27420 (WHC-SA–2453) **Waste immobilization demonstration program for the Hanford Site's Mixed Waste Facility.** Burbank, D.A.; Weingardt, K.M. Westinghouse Hanford Co., Richland, WA (United States). May 1994. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-940815–46: International nuclear and hazardous waste management conference, Atlanta, GA (United States), 14-18 Aug 1994). Order Number DE94014121. Source: OSTI; NTIS; INIS; GPO Dep.

This paper presents an overview of the Waste Receiving and Processing facility, Module 2A> waste immobilization demonstration program, focusing on the cooperation between Hanford Site, commercial, and international participants. Important highlights of the development and demonstration activities is discussed from the standpoint of findings that have had significant from the standpoint of findings that have had significant impact on the evolution of the facility design. A brief description of the future direction of the program is presented, with emphasis on the key aspects of the technologies that call for further detailed investigation.

27421 (WHC-SA–2462) **Bagless transfer technology applications in Hanford's WRAP-1 Facility.** Leist, K.J. Westinghouse Hanford Co., Richland, WA (United States). Aug 1994. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-940815–68: International nuclear and hazardous waste management conference, Atlanta, GA (United States), 14-18 Aug 1994). Order Number DE94015646. Source: OSTI; NTIS; INIS; GPO Dep.

The Waste Receiving and Processing Facility, under construction at in south-central Washington State. The facility is scheduled to begin operation in 1996. Designed as a joint venture by Raytheon Engineers and Constructors and British Nuclear Fuels, Ltd. (BNFL), its mission is to annually receive more than 6,800 55-gallon drums of both newly generated and retrieved contact-handled solid waste and prepare them for certification and disposal. While 3,800 drums will require only waste acceptance criteria certification using the WRAP-1 NDA/NDE functions, 3,000 drums also will need to be repackaged. The WRAP-1 Facility will use two separate glovebox lines to annually repackage more than 1,500 drums each of transuranic (TRU) and low-level waste (LLW) to meet current disposal guidelines. When complete, WRAP-1 will be the first facility of its kind to perform these tasks on a production scale. Completing this challenging task is made possible by using large-container (drum) bagless transfer technology and state-of-the-art glovebox design.

27422 (WHC-SA–2478) **Status of test results of electrochemical organic oxidation of a tank 241-SY-101 simulated waste.** Colby, S.A. Westinghouse Hanford Co., Richland, WA (United States). Jun 1994. 26p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-940853–3: Summer meeting of the American Institute of Chemical Engineers, Denver, CO (United States), 14-17 Aug 1994). Order Number DE94015710. Source: OSTI; NTIS; INIS; GPO Dep.

This report presents scoping test results of an electrochemical waste pretreatment process to oxidize organic compounds contained in the Hanford Site's radioactive waste storage tanks. Electrochemical oxidation was tested on laboratory scale to destroy organics that are thought to pose safety concerns, using a nonradioactive, simulated tank waste. Minimal development work has been applied to alkaline electrochemical organic destruction. Most electrochemical work has been directed towards acidic electrolysis, as in the metal purification industry, and silver catalyzed oxidation. Alkaline electrochemistry has traditionally been associated with the following: (1) inefficient power use, (2) electrode fouling, and (3) solids handling problems. Tests using a laboratory scale electrochemical cell oxidized surrogate organics by applying a DC electrical current to the simulated tank waste via anode and cathode electrodes. The analytical data suggest that alkaline electrolysis oxidizes the organics into inorganic carbonate and smaller carbon chain refractory organics. Electrolysis treats the waste without adding chemical reagents and at ambient conditions of temperature and pressure. Cell performance was not affected by varying operating conditions and supplemental electrolyte additions.

27423 (WHC-SD-EN-AP–166) **Description of work for 216-U-1 and 216-U-2 stainless steel pipeline integrity testing.** Wasemiller, M.A. Westinghouse Hanford Co., Richland, WA (United States). 30 Jun 1994. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE94015706. Source: OSTI; NTIS; INIS; GPO Dep.

The objectives of this integrity test are to (1) inspect the interior of this pipeline by in-line camera survey and (2) if required, conduct a pressure test on a section of the pipeline. The U-1 and U-2 Cribs were constructed in 1951. From March 1952 to June 1967, the site received cell drainage from Tank 5-2 in the 221-U Building nd waste from the 224-U Building via the overflow from the 241-U-361 Settling Tank. From June 1957 to July 1957, the site received waste from the 224-U Building via the overflow from the 241-U-361 Settling Tank and contaminated solvent from the 276-U Settling Tank solvent storage area. The discharge of 221-U waste was discontinued during shutdown of production operations. From July 1957 to May 1967, the site received waste from the 224-U Building and equipment decontamination and reclamation wastes from operations in the 221-U Building canyon. The scope of work is encompassed in five steps: (1) obtaining access to the pipeline in order to perform an in-line camera survey of the line to the greatest extent possible, (2) evaluating the need for further investigation of the pipeline, (3) blanking the line, as needed, to perform a pressure test, (4) conducting the pressure test, as needed, and (5) documenting the ability of the line to maintain pressure.

27424 (WHC-SD-EN-ES–040) **Engineering study of 50 miscellaneous inactive underground radioactive waste tanks located at the Hanford Site, Washington.** Freeman-Pollard, J.R. Westinghouse Hanford Co., Richland, WA (United States). 2 Mar 1994. 341p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE94014123. Source: OSTI; NTIS; INIS; GPO Dep.

This engineering study addresses 50 inactive underground radioactive waste tanks. The tanks were formerly used for the following functions associated with plutonium and uranium separations and waste management activities in the 200 East and 200 West Areas of the Hanford Site: settling solids prior to disposal of supernatant in cribs and a reverse well; neutralizing acidic process wastes prior to crib disposal; receipt and processing of single-shell tank (SST) waste for uranium recovery operations; catch tanks to collect water that intruded into diversion boxes and transfer pipeline encasements and any leakage that occurred during waste transfer operations; and waste handling and process experimentation. Most of these tanks have not been in use for many years. Several projects have, been planned and implemented since the 1970's and through 1985 to remove waste and interim isolate or interim stabilize many of the tanks. Some tanks have been filled with grout within the past several years. Responsibility for final closure and/or remediation of these tanks is currently assigned to several programs including Tank Waste Remediation Systems (TWRS), Environmental Restoration and Remedial Action (ERRA), and Decommissioning and Resource Conservation and Recovery Act (RCRA) Closure (D&RCP). Some are under facility landlord responsibility for maintenance and surveillance (i.e. Plutonium Uranium Extraction [PUREX]). However, most of the tanks are not currently included in any active monitoring or surveillance program.

27425 (WHC-SD-EN-TI–213) **Geophysical investigations of French Drain 116-B-9, and Dry Well 116-B-10, 100 B/C Area.** Bergstrom, K.A.; Fassett, J.W. Westinghouse Hanford Co., Richland, WA (United States). [1994]. 14p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE94015724. Source: OSTI; NTIS; GPO Dep.

French Drain 116-B-9 and Dry Well 116-B-10 are both located within the 100 B/C-2 Operable Unit, 100 B/C Area (Figure 1). The 116-B-9 French Drain is approximately 4 ft in diameter by 3 ft deep. The exact location or use of the drain in not clear. The 116-B-10 Dry Well is a 3 ft-diameter, tile-lined well on a concrete slab, 7 ft below the surface, overlain by a manhole cover (DOE-RL 1991). The exact location of the well is uncertain. The objective of the survey was to locate the Dry Well and the French Drain. The area to be investigated had several buildings in the area which subsequently have been torn down. Ground penetrating radar (GPR) was the geophysical method chosen for the investigation.

27426 (WHC-SD-WM-PTR–011) **Concentrator E-F11 water test.** Ethington, P.R. Westinghouse Hanford Co., Richland, WA (United States). 25 Feb 1994. 86p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE94012392. Source: OSTI; NTIS; INIS; GPO Dep.

This document is the Process Test Report for performing operation testing with water of the modified E-F11 concentrator in PUREX on water. The test was performed to determine the effects of the following concentrator modifications; routing concentrator offgasses via the PUREX air tunnel to the main stack, blanking of condenser cooling water, blanking of process condensate route to a crib, restricting flow to steam tube bundles, and routing of steam condensate to TK-F12. The test was successful. Concentrator boil-off rates of 6–7 gpm were achieved while the overheads exited the PUREX plant in vapor form. With minor recommended modifications, this process is recommended for use in processing PUREX deactivation flush solutions and other miscellaneous wastes accumulated during the completion of the deactivation project.

27427 (WHC-SD-WM-SP–001) **Subsurface barrier demonstration test strategy and performance specification.** Treat, R.L.; Cruse, J.M. Westinghouse Hanford Co., Richland, WA (United States). May 1994. 96p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE94016460. Source: OSTI; NTIS; INIS; GPO Dep.

This document was developed to help specify a major demonstration test project of subsurface barrier systems supporting the Tank Waste Remediation System (TWRS) Program. The document focuses discussion on requirements applicable to demonstration of three subsurface barrier concepts: (1) Injected Material, (2) Cryogenic, and (3) Desiccant. Detailed requirements are provided for initial qualification of a technology proposal followed by the pre-demonstration and demonstration test requirements and specifications. Each requirement and specification is accompanied by a discussion of the rationale for it. The document also includes information on the Hanford Site tank farms and related data; the related and currently active technology development projects within the DOE's EM-50 Program; and the overall demonstration test strategy. Procurement activities and other preparations for actual demonstration testing are on hold until a decision is made regarding further development of subsurface barriers. Accordingly, this document is being issued for information only.

27428 (WINCO–1157) **Preliminary waste acceptance criteria for the ICPP spent fuel and waste management technology development program.** Taylor, L.L.; Shikashio, R. Westinghouse Idaho Nuclear Co., Inc., Idaho Falls, ID (United States). Sep 1993. 219p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-84ID12435. Order Number DE94008915. Source: OSTI; NTIS; INIS; GPO Dep.

The purpose of this document is to identify requirements to be met by the Producer/Shipper of Spent Nuclear Fuel/High-Level Waste SNF/HLW in order for DOE to be able to accept the packaged materials. This includes defining both standard and non-standard waste forms.

27429 (WINCO–1162) **Calcined waste inventory for Calcined Solids Storage Facility IV.** Penwell, D.L. Westinghouse Idaho Nuclear Co., Inc., Idaho Falls, ID (United States). Oct 1993. 35p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-84ID12435. Order Number DE94013805. Source: OSTI; NTIS; INIS; GPO Dep.

During the period from August 28, 1982 to July 15, 1983, the New Waste Calcining Facility (NWCF) converted aqueous nuclear fuel reprocessing waste into calcine solids. The solids are stored in the fourth Calcined Solids Storage Facility (CSSF), where they are isolated from the environment. An inventory of the calcined waste in Solids Storage IV was prepared using information from the NWCF startup data, NWCF feed data, Tank Farm sample data, calcine sample data, and Solid Storage IV thermocouple data. Solids Storage IV contains dolomite and cold alumina, alumina-zirconia blend, of zirconia, and zirconia-sodium blend. As of January 1, 1984 the calcine in Solid Storage IV contained 9.051 x

10^6 curies of radioactivity based upon the volume and activity of the liquid calcined. The calculated versus actual calcine volumes were compared. It was determined that the calculated volume is reasonably accurate (within 5%) except when the sample results for the waste appeared unreliable. The calculated calcine temperature was compared to the actual temperature and was within 2% of the actual temperature when the waste sample results gave an accurate calcine volume.

27430 (WINCO–1206) **TRUEX partitioning studies applied to ICPP sodium-bearing waste.** Herbst, R.S.; Brewer, K.N.; Law, J.D.; Tranter, T.J.; Todd, T.A. Westinghouse Idaho Nuclear Co., Inc., Idaho Falls, ID (United States). May 1994. 73p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-84ID12435. Order Number DE94015532. Source: OSTI; NTIS; INIS; GPO Dep.

The Idaho Chemical Processing Plant (ICPP), located in southeast Idaho at the USDOE Idaho National Engineering Laboratory, formerly reprocessed highly enriched spent nuclear fuel to recover fissionable uranium. The HLW raffinates from the combined PUREX/REDOX type uranium recovery process were converted to solid oxides (calcine) in a high temperature fluidized bed. Liquid effluents from the calcination process were combined with liquid sodium bearing waste (SBW) generated primarily in conjunction with decontamination activities. Due to the high sodium content in the SBW, this secondary waste stream is not directly amenable to solidification via calcination. Currently, approximately 1.5 millon gallons of liquid SBW are stored at the ICPP in large tanks. Several treatment options for the SBW are currently being considered, including the TRansUranic EXtraction (TRUEX) process developed by Horwitz and co-workers at Argonne National Laboratory (ANL), in preparation for the final disposition of SBW. Herein described are experimental results of radionuclide tracer studies with simulated SBW using the TRUEX process solvent.

27431 (WSRC-MS–93-412) **Operational readiness review of the Low Level Waste vaults at Savannah River Site: A case study.** Ahmad, M.; McVay, C.; Venkatesh, S. Westinghouse Savannah River Co., Aiken, SC (United States). [1994]. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035. (CONF-940748–18: Institute of Nuclear Materials Management annual meeting, Naples, FL (United States), 17-20 Jul 1994). Order Number DE94015547. Source: OSTI; NTIS; INIS; GPO Dep.

Low Level radioactive Waste (LLW) at the Savannah River Site at Aiken, South Carolina, has traditionally been disposed of using engineered trenches in accordance with the guidelines and technology existing at the time. Recently, subgrade concrete vaults known as E-Area Vaults (EAV) have been constructed at SRS. The EAV project is a comprehensive effort for upgrading LLW disposal at SRS based on meeting the requirements of current Department of Energy (DOE) Orders, and addressing more stringent federal and state regulations. The EAV is a first of its kind state-of-the-art facility designed and built in the United States to receive LLW. Westinghouse Savannah River Company (WSRC) conducted an Operational Readiness Review (ORR) of the vaults prior to startup. The objective of the EAV ORR was to perform a comprehensive review of the operational readiness of the facilities per DOE guidelines including Defense Nuclear Facilities Safety Board (DNFSB) recommendations. This review included assessing construction of the vaults as per design, adequate approved procedures, and training of all the personnel associated with the facility operations. EAV ORR incorporated the lessons learned from other DOE ORRs, included DNFSB recommendations, used a graded approach, and utilized subject matter experts for each functional area of assessment.

27432 (WSRC-MS–94-027) **Improved method for determining tank heel volumes.** Holt, S.H.; Livingston, R.R.; Nave, S.E. Westinghouse Savannah River Co., Aiken, SC (United States). [1994]. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035. (CONF-940748–19: Institute of Nuclear Materials Management annual meeting, Naples, FL (United States), 17-20 Jul 1994). Order Number DE94015554. Source: OSTI; NTIS; GPO Dep.

As part of the tank calibration process, the instrument heel is that part of the tank that cannot be measured by the liquid level instrumentation. If the tank being calibrated is not a bottom drain tank, some volume of fluid will be present in the bottom of the tank after draining as much as possible. The amount of fluid remaining in the tank at the start of each run can be estimated by measuring a concentration change of an added spiking material. With the great improvement of liquid level measuring instruments, the total error associated with the instrument heel determination can be greatly affected by the laboratory method used to measure the concentration difference. At the Savannah River Site, the laboratory method used has historically been Direct Current Plasma Emission Spectroscopy, which yielded very marginal results at best. In the most recent tank calibrations, the laboratory method was changed to Absorption Spectrophotometry, which reduces the total error on the instrument heel measurement by a factor of 2.5 times. This paper describes the method used to determine tank instrument heels and the improvements made to this process.

27433 (WSRC-MS–94-0110) **The changing role of Material Control and Accountability at Savannah River Site.** Rodriguez, M.P. Westinghouse Savannah River Co., Aiken, SC (United States). [1994]. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035. (CONF-940748–16: Institute of Nuclear Materials Management annual meeting, Naples, FL (United States), 17-20 Jul 1994). Order Number DE94015569. Source: OSTI; NTIS; INIS; GPO Dep.

As Westinghouse Savannah River Company has been faced with the challenge of better meeting DOE needs with reduced budgets and manpower, the Materials Control and Accountability (MC&A) organization has taken a hard look at its roles and responsibilities. A MC&A program is composed of many functions that can not only meet safeguards needs, but can be used by several organizations across the site to meet their needs as well. These functions include nuclear material measurements, tracking, accounting, and inventory control. The infrastructure in place to provide these functions for accountable nuclear materials requires only a few adjustments to expand to other areas of nuclear materials accounting and control. By integrating several organizations' requirements, the MC&A section can allow line organizations to reduce their costs and rely on the section to better service their needs. On the reverse side, MC&A has completed several cost reduction measures that will allow it to expand its role with no increased costs. The roles and responsibilities of the nuclear material control and accountability program should be expanded. The program's existing information infrastructure, and knowledge and experience in nuclear material measurements and safeguards can be built upon to meet the needs of new areas such as waste management and decommissioning and decontamination while continuing to support the existing processing and storage efforts of current facilities.

27434 (WSRC-MS–94-0133) **Process for removing and detoxifying cadmium from scrap metal including mixed waste.** Kronberg, J.W. Westinghouse Savannah River Co., Aiken, SC (United States). [1994]. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035. (CONF-940748–20: Institute of Nuclear Materials Management annual meeting, Naples, FL (United States), 17-20 Jul 1994). Order Number DE94015565. Source: OSTI; NTIS; INIS; GPO Dep.

Cadmium-bearing scrap from nuclear applications, such as neutron shielding and reactor control and safety rods, must usually be handled as mixed waste since it is radioactive and the cadmium in it is both leachable and highly toxic. Removing the cadmium from this scrap, and converting it to a nonleachable and minimally radioactive form, would greatly simplify disposal or recycling. A process now under development will do this by shredding the scrap; leaching it with reagents which selectively dissolve out the cadmium; reprecipitating the cadmium as its highly insoluble sulfide; then fusing the sulfide into a glassy matrix to bring its leachability below EPA limits before disposal. Alternatively, the cadmium may be recovered for reuse. A particular advantage of the process is that all reagents (except the glass frit) can easily be recovered and reused in a nearly closed cycle, minimizing the risk of radioactive release. The process does not harm common metals such as

aluminum, iron and stainless steel, and is also applicable to non-nuclear cadmium-bearing scrap such as nickel-cadmium batteries.

27435 (WSRC-MS–94-0163) **Measurement of actinides and strontium-90 in high activity waste.** Maxwell, S.L. III; Nelson, M.R. Westinghouse Savannah River Co., Aiken, SC (United States). [1994]. 22p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035. (CONF-940748–12: Institute of Nuclear Materials Management annual meeting, Naples, FL (United States), 17-20 Jul 1994). Order Number DE94015838. Source: OSTI; NTIS; INIS; GPO Dep.

The reliable measurement of trace radionuclides in high activity waste is important to support waste processing activities at SRS (F and H Area Waste Tanks, Extended Sludge Processing (ESP) and In-Tank precipitation (ITP) processing). Separation techniques are needed to remove high levels of gamma activity and alpha/beta interferences prior to analytical measurement. Using new extraction chromatographic resins from EiChrom Industries, Inc., the SRS Central Laboratory has developed new high speed separation methods that enable measurement of neptunium, thorium, uranium, plutonium, americium and strontium-90 in high activity waste solutions. Small particle size resin and applied vacuum are used to reduce analysis times and enhance column performance. Extraction chromatographic resins are easy to use and eliminate the generation of contaminated liquid organic waste.

27436 (WSRC-MS–94-0274) **Decontamination and decommissioning waste characterization and cost estimates from historical records.** Hootman, H.E. Westinghouse Savannah River Co., Aiken, SC (United States). [1994]. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035. (CONF-940815–58: International nuclear and hazardous waste management conference, Atlanta, GA (United States), 14-18 Aug 1994). Order Number DE94014863. Source: OSTI; NTIS; INIS; GPO Dep.

There are more than 600 facilities at the Savannah River Site (SRS) that are contaminated with either radioactivity, hazardous chemicals, or asbestos. The more significant facilities can be separated into broad categories for decontamination and decommissioning (D&D) planning such as plutonium facilities, waste tanks, chemical separations canyons, and nuclear reactors. Uncertainties exist in the timing, extent of stabilization, and D&D required for these production facilities. Detailed analyses of the risk, costs, and engineering feasibility are needed to define production facility end states to ensure expected reduction in health and environmental risk. In the meantime, scoping projections are required to satisfy Department of Energy (DOE) requirements for 30 year plans, and to indicate where detailed analysis should be funded.

27437 (WSRC-MS–94-0328) **Waste tank inspection and characterization with automated UT and robotics.** McIntosh, J.B. Westinghouse Savannah River Co., Aiken, SC (United States). [1994]. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035. (CONF-940815–55: International nuclear and hazardous waste management conference, Atlanta, GA (United States), 14-18 Aug 1994). Order Number DE94014651. Source: OSTI; NTIS; INIS; GPO Dep.

Equipment and Materials Technology (E&MT of the Westinghouse Savannah river Company) has developed a robotic system to deliver an ultrasonic transducer to the wall of underground storage tanks (USTs). The system is designed to meet the physical and environmental constraints of the USTs and will provide the ability to visually survey the wall, clean the surface and ultrasonically map the wall thickness.

27438 (WSRC-MS–94-0331) **Statistical process control support during Defense Waste Processing Facility chemical runs.** Brown, K.G. Westinghouse Savannah River Co., Aiken, SC (United States). [1994]. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035. (CONF-940815–51: International nuclear and hazardous waste management conference, Atlanta, GA (United States), 14-18 Aug 1994). Order Number DE94014650. Source: OSTI; NTIS; INIS; GPO Dep.

The Product Composition Control System (PCCS) has been developed to ensure that the wasteforms produced by the Defense Waste Processing Facility (DWPF) at the Savannah River Site (SRS) will satisfy the regulatory and processing criteria that will be imposed. The PCCS provides rigorous, statistically-defensible management of a noisy, multivariate system subject to multiple constraints. The system has been successfully tested and has been used to control the production of the first two melter feed batches during DWPF Chemical Runs. These operations will demonstrate the viability of the DWPF process. This paper provides a brief discussion of the technical foundation for the statistical process control algorithms incorporated into PCCS, and describes the results obtained and lessons learned from DWPF Cold Chemical Run operations. The DWPF will immobilize approximately 130 million liters of high-level nuclear waste currently stored at the Site in 51 carbon steel tanks. Waste handling operations separate this waste into highly radioactive sludge and precipitate streams and less radioactive water soluble salts. (In a separate facility, soluble salts are disposed of as low-level waste in a mixture of cement slag, and flyash.) In DWPF, the precipitate steam (Precipitate Hydrolysis Aqueous or PHA) is blended with the insoluble sludge and ground glass frit to produce melter feed slurry which is continuously fed to the DWPF melter. The melter produces a molten borosilicate glass which is poured into stainless steel canisters for cooling and, ultimately, shipment to and storage in a geologic repository.

27439 (WSRC-RP–93-1376) **Dismantlement and decontamination of a plutonium-238 facility at SRS.** Smith, R.H. Jr.; Hootman, H.E. Westinghouse Savannah River Co., Aiken, SC (United States). Jan 1994. 16p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035. Order Number DE94014575. Source: OSTI; NTIS; INIS; GPO Dep.

There has been very little, documented decontamination and decommissioning (D&D) experience on which to project cleanup costs and schedules for plutonium facilities at SRS and other DOE sites. A portion of the HB-Line, a plutonium-238 processing facility at SRS, has been undergoing D&D intermittently since 1984. Although this cleanup effort was not originally intended to quantify results, some key data have been project has demonstrated effective methods of accumulated, and the performing D&D work, and has demonstrated cleanup equipment and techniques under conditions of high contamination. Plutonium facilities where D&D is already underway provide an opportunity for' timely field testing of characterization, size reduction, and decontamination techniques. Some data are presented here; however, more specific tests and data may be obtained during the remainder of this project. This project has been recommended as a candidate test facility for a DOE planned "Integrated D&D Demonstration" managed by EM-50 to develop and demonstrate technology for D&D and surplus facilities deactivation. Both the remainder of this project and the Integrated D&D Demonstration Program can benefit from a joint effort, and the, overall costs should be reduced.

27440 (WSRC-TN–6) **Technical standard: Management of radioactive waste at the SRS storage/disposal facilities, 643-7G, 643-29G, 709-2G.** Cook, J.R. Westinghouse Savannah River Co., Aiken, SC (United States). Jun 1990. 23p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035. Order Number DE94015551. Source: OSTI; NTIS; INIS; GPO Dep.

This Standard applies to the storage or disposal of Low-Level Radioactive Waste and Transuranic Waste at the Savannah River Site (SRS) Radioactive Waste Storage/Disposal Facility 643-7G, and to the storage of Mixed Waste at facilities 643-29G and 709-2G. This Standard applies only to current operations. The objective for prescribing the requirements in this Standard is to provide for storage and disposal of radioactive waste at SRS in a manner that will ensure the safety and health of employees and of the public, and that will protect the environment. The Technical Standards and Operational Safety Requirements are the formal instruments for setting boundaries for administrative control of all processes.

27441 (WSRC-TR–94-075) **Savannah River Site environmental report for 1993.** Arnett, M.W.; Karapatakis, L.K.; Mamatey, A.R. (eds.). Westinghouse Savannah River Co., Aiken, SC (United States). [1994]. 276p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035. Order Number DE94016527. Source: OSTI; NTIS; INIS; GPO Dep.

Savannah River Site (SRS) conducts effluent monitoring and environmental surveillance to ensure the safety of the public and the well-being of the environment. DOE Order 5400,1, "General Environmental Protection Program," requires the submission of an environmental report that documents the impact of facility operations on the environment and on public health. SRS has had an extensive environmental surveillance program in place since 1951 (before site startup). At that time, data generated by the on-site surveillance program were reported in site documents. Beginning in 1959, data from off-site environmental monitoring activities were presented in reports issued for public dissemination. Separate reporting of SRS's on- and off-site environmental monitoring activities continued until 1985, when data from both surveillance programs were merged into a single public document. The Savannah River Site Environmental Report for 1993 is an overview of effluent monitoring and environmental surveillance activities conducted on and in the vicinity of SRS from January 1 through December 31, 1993. For complete program descriptions, consult the "SRS Environmental Monitoring Plan" (WSRC-3QI-2-1000). It documents the rationale and design criteria for the monitoring program, the frequency of monitoring and analysis, the specific analytical and sampling procedures, and the quality assurance requirements.

27442 (WSRC-TR–94-100-2) **Savannah River Technology Center: Monthly report.** Westinghouse Savannah River Co., Aiken, SC (United States). Feb 1994. 36p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035. Order Number DE94016537. Source: OSTI; NTIS; GPO Dep.

This document contains information about the research programs being conducted at the Savannah River Plant. Topics of discussion include: thermal cycling absorption process, development of new alloys, ion exchange, oxalate precipitation, calcination, environmental research, remedial action, ecological risk assessments, chemical analysis of salt cakes, natural phenomena hazards assessment, and sampling of soils and groundwater.

27443 (WSRC-TR–94-100-3) **Savannah River Technology Center monthly report.** Westinghouse Savannah River Co., Aiken, SC (United States). Mar 1994. 34p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035. Order Number DE94016538. Source: OSTI; NTIS; GPO Dep.

This document contains information about the research programs being conducted at the Savannah River Plant. Topics of discussion include: Acorn Cleaning Study, tritium, separation processes, bioremediation programs, environmental remediation, environmental sampling, waste management, statistical design, phase I array experiments, and, Monte Carlo Neutron Photon input files.

27444 (WSRC-TR–94-0194-Rev.1) **Guidelines for acceptable soil concentrations in the Old F- and H-Area Retention Basins: Revision 1.** Hamby, D.M. Westinghouse Savannah River Co., Aiken, SC (United States). 18 Apr 1994. 22p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035. Order Number DE94015830. Source: OSTI; NTIS; INIS; GPO Dep.

Concentration guidelines for residual radionuclides in soil at the sites of the Old F- and a Retention Basins (281-3F, 281-3H) have been calculated using a dose-based approach. The guidelines also are being applied to areas around the F-Basin's Process Line. Estimation of these soil guidelines was completed using RESRAD 5.0 in accordance with the DOE RESRAD methodology specified in DOE/CH/8901 (Gi89). Guidelines are provided for the nuclides known to be present in the soils at each basin (Sc87). Soil and hydrologic characteristics specific to each basin are defined for the areas above, within, and beneath the contaminated zones.

27445 (WSRC-TR–94-0227) **Assessment of uranium, plutonium, and Np-237 content of high level liquid waste on E-Area vault package limits.** Clemmons, J.S. Westinghouse Savannah River Co., Aiken, SC (United States). 8 Jun 1994. 19p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035. Order Number DE94015834. Source: OSTI; NTIS; INIS; GPO Dep.

The purpose of this report is to assess the waste tank inventory of uranium, plutonium and Np-237 to determine potential impacts on waste certification for the E-Area vaults (EAV). Procedure WAC 3.10, Rev. 1, of the 1S Manual imposes administrative control limits for radioactive material in waste packages sent to the EAV. Waste tank supernate contains trace amounts of U, Pu, and Np. Thus any material contaminated with supernate and placed in a B-25 waste package may contain one or more of these elements' radioactive isotopes. This report uses material inventory data, solubility data and tank volumes to determine the potential-, for waste packages, contaminated with waste tank supernate, to exceed the administrative control limits of procedure WAC 3. 10, Rev. 1, for U-233, U-234, U-235, U-236, U-238, Np-237, Pu-238, Pu-239, Pu-240, Pu-241, and Pu-242.

27446 (WSRC-TR–94-0257) **Remedial technology and characterization development at the SRS F/H Retention Basins using the DOE SAFER methodology.** Miles, W.C. Jr.; Kuelske, K.J. Westinghouse Savannah River Co., Aiken, SC (United States). [1994]. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035. (CONF-940815–54: International nuclear and hazardous waste management conference, Atlanta, GA (United States), 14-18 Aug 1994). Order Number DE94014652. Source: OSTI; NTIS; INIS; GPO Dep.

The Streamlined Approach For Environmental Restoration (SAFER) is a strategy used to accelerate and improve the environmental assessment and remediation of the F/H Retention Basins at the Savannah River Site (SRS). TMs strategy combines the data quality objectives (DQO) process and the observational approach to focus on data collection and converge on a remedial action early. This approach emphasizes stakeholder involvement throughout the Remedial Investigation/Feasibility Study (RI/FS) process. The SAFER methodology is being applied to the characterization, technology development, and remediation tasks for the F/H Retention Basins. This "approach was initiated in the scoping phase of these projects through the involvment of major stakeholders; Department of Energy (DOE)-Savannah River Field Office, DOE-Headquarters, Westinghouse Savannah River Company, United States Environmental Protection Agency (EPA) Region IV, and the state of South Carolina Department of Health and Environmental Control (SCDHEC), in the development of the Remedial Investigation (RI) workplans. A major activity that has been initiated is the development and implementation of a phase I workplan to identify preliminary contaminants of concern (pCOCs). A sampling plan was developed and approved by the major stakeholders for preliminary characterization of wastes remaining in the F/H Retention Basins. The involvement of stakeholders, development of a site conceptual model, development of remedial objectives for probable conditions, identification of the problem and reasonable deviations, and development of initial decision rules in the planning stages will ensure that preliminary data needs are identified and obtained prior to the initiation of the assessment and implementation phases of the projects resulting in the final remediation of the sites in an accelerated and more cost effective manner.

27447 (WSRC-TR–94-0269) **Nuclear criticality safety evaluation of the passage of decontaminated salt solution from the ITP filters into tank 50H for interim storage.** Hobbs, D.T.; Davis, J.R. Westinghouse Savannah River Co., Aiken, SC (United States). 27 May 1994. 14p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035. Order Number DE94015549. Source: OSTI; NTIS; INIS; GPO Dep.

This report assesses the nuclear criticality safety associated with the decontaminated salt solution after passing through the In-Tank Precipitation (ITP) filters, through the stripper columns and into Tank 50H for interim storage until transfer to the Saltstone facility. The criticality safety basis for the ITP process is documented. Criticality safety in the ITP filtrate has been analyzed under normal and process upset conditions. This report evaluates the potential for criticality due to the precipitation or crystallization of fissionable material from solution and an ITP process filter failure in which insoluble material carryover from salt dissolution is present. It is concluded that no single inadvertent error will cause criticality and that the process will remain subcritical under normal and credible abnormal conditions.

27448 (Y/WM–187) **Industrial Waste Landfill IV upgrade package.** Oak Ridge Y-12 Plant, TN (United States). 29 Mar 1994. 306p. Sponsored by USDOE, Washington, DC (United States).

DOE Contract AC05-84OS21400. Order Number DE94010024. Source: OSTI; NTIS; INIS; GPO Dep.

Engineering drawings for this project are identified as CAPE-3078. Inquiries may be directed to: Office of Scientific and Technical Information, P. O. Box 62, Oak Ridge, TN 37831.

The Y-12 Plant, K-25 Site, and ORNL are managed by DOE's Operating Contractor (OC), Martin Marietta Energy Systems, Inc. (Energy Systems) for DOE. Operation associated with the facilities by the Operating Contractor and subcontractors, DOE contractors and the DOE Federal Building result in the generation of industrial solid wastes as well as construction/demolition wastes. Due to the waste streams mentioned, the Y-12 Industrial Waste Landfill IV (IWLF-IV) was developed for the disposal of solid industrial waste in accordance to Rule 1200-1-7, Regulations Governing Solid Waste Processing and Disposal in Tennessee. This revised operating document is a part of a request for modification to the existing Y-12 IWLF-IV to comply with revised regulation (Rule Chapters 1200-1-7-.01 through 1200-1-7-.08) in order to provide future disposal space for the ORR, Subcontractors, and the DOE Federal Building. This revised operating manual also reflects approved modifications that have been made over the years since the original landfill permit approval. The drawings referred to in this manual are included in Drawings section of the package. IWLF-IV is a Tennessee Department of Environmental and Conservation/Division of Solid Waste Management (TDEC/DSWM) Class 11 disposal unit.

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Refer also to citation(s) 27325, 27326, 27343, 27357, 27368, 27369, 27373, 27393, 27404, 27405, 27483, 27489

27449 (ARH–243) **Determining acceptable stack concentrations for gaseous wastes released to the atmosphere.** Brown, D.J. Atlantic Richfield Hanford Co., Richland, WA (United States). 7 Nov 1967. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE94015234. Source: OSTI; NTIS; GPO Dep.

The following information is provided to assist you with your engineering evaluation of the gaseous wastes released to the atmosphere via stacks and roof vents in the 200 Areas for inclusion in the Hanford Low Level Waste Management Reevaluation Study report. Included in discussion are: release rates and public radiation dose rates.

27450 (DOE/EA–0845) **Expansion of the Idaho National Engineering Laboratory Research Center: Environmental assessment.** USDOE Idaho Operations Office, Idaho Falls, ID (United States). Mar 1994. 51p. Sponsored by USDOE, Washington, DC (United States). Order Number DE94015405. Source: OSTI; NTIS; INIS; GPO Dep.

The US Department of Energy (DOE) proposes to expand and upgrade facilities at the Idaho National Engineering Laboratory (INEL) Research Center (IRC) by constructing a research laboratory addition on the northeast corner of existing laboratory building; upgrading the fume hood system in the existing laboratory building; and constructing a hazardous waste handling facility and a chemical storage building. The DOE also proposes to expand the capabilities of biotechnology research programs by increasing use of radiolabeled compounds to levels in excess of current facility limits for three radionuclides (carbon-14, sulfur-35, and phosphorus-32). This Environmental assessment identifies the need for the new facilities, describes the proposed projects and environmental setting, and evaluates the potential environmental effects. Impacts associated with current operation are discussed and established as a baseline. Impacts associated with the proposed action and cumulative impacts are described against this background. Alternatives to the proposed action (No action; Locating proposed facilities at a different site) are discussed and a list of applicable regulations is provided. The no action alternative is continuation of existing operations at existing levels as described in Section 4 of this EA. Proposed facilities could be constructed at a different location, but these facilities would not be useful or practical since they are needed to provide a support function for IRC operations. Further, the potential environmental impacts would not be reduced if a different site was selected.

27451 (DOE/RL–93-24-7) **Hanford Environmental Information System (HEIS): Volume 7: Sample and Data Tracking subject area.** USDOE Richland Operations Office, WA (United States). Jun 1994. 36p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE94015638. Source: OSTI; NTIS; INIS; GPO Dep.

The Hanford Environmental Information System (HEIS) Sample and Data Tracking subject area allows insertion of tracking information into a central repository where the data is immediately available for viewing. For example, a technical coordinator is able to view the current status of a particular sampling effort, from sample collection to data package validation dates. Four major types of data comprise the Sample and Data Tracking subject area: data about the mechanisms that groups a set of samples for a particular sampling effort; data about how constituents are grouped and assigned to a sample; data about when, where, and how samples are sent to a laboratory for analysis; and data bout the status of a sample's constituent analysis requirements, i.e., whether the analysis results have been returned from the laboratory.

27452 (DOE/RL–93-37) **Limited field investigation report for the 100-BC-5 Operable Unit.** USDOE Richland Operations Office, WA (United States). Jul 1994. 78p. Sponsored by USDOE, Washington, DC (United States). Order Number DE94015330. Source: OSTI; NTIS; INIS; GPO Dep.

This limited field investigation (LFI) was conducted to assess the applicability of interim remedial measures (IRM) for reducing human health and environmental risks within the 100-BC-5 Groundwater Operable Unit. The 100-BC-5 Operable Unit is one of three operable units associated with the 100 B/C Area. Operable units 1 and 2 address contaminant sources while 100-BC-5 addresses contamination present in the underlying groundwater. The primary method of investigation used during this LFI was the installation of monitoring wells. Samples were collected from the groundwater and soils and submitted for laboratory analysis. Boreholes were surveyed for radiological contamination using downhole geophysical techniques to further delineate the locations and levels of contaminants. All samples were screened to ascertain the presence of volatile organic compounds and radionuclides. Analytical data were subjected to validation; all first round and 10% of the subsequent rounds of data associated with the LFI were validated. The screening method was used to identify contaminants of potential concern (COPC). This screening method eliminated from further consideration constituents that were below background. Constituents considered nontoxic to humans were eliminated from the human health evaluation. Inconsistency and blank contamination were also evaluated in the screening process. These COPC were evaluated further in the qualitative risk assessment (QRA). Tritium and strontium-90 were identified as contaminants of concern at 100-BC-5 because the concentrations exceeded potential applicable or relevant and appropriate requirements. The QRA determined that the risk is low for all of the site contaminants.

27453 (DOE/RL–94-51) **Radionuclide air emission report for the Hanford Site Calendar Year 1993.** Diediker, L.P. (Westinghouse Hanford Co., Richland, WA (United States)); Cum, B.L.; Rhoads, K.; Damberg, E.G.; Soldat, J.K.; Jette, S.J. Department of Energy, Richland, WA (United States). Richland Operations Office. [1994]. 113p. Sponsored by USDOE, Washington, DC (United States). Order Number DE94016462. Source: OSTI; NTIS; INIS; GPO Dep.

This report documents radionuclide air emissions from the Hanford Site in 1993 and the resulting effective dose equivalent to any member of the public. The report has been prepared and will be submitted in accordance with reporting requirements in the Code of Federal Regulations, Title 40, Protection of the Environment, Part 61, "National Emissions Standards for Hazardous Air Pollutants," Subpart H, "National Emission Standards for Emissions of Radionuclides Other than Radon from Department of Energy Facilities."

27454 (DOE/RW/00134–T11) **Review and selection of unsaturated flow models.** Reeves, M. (INTERA, Inc., Las Vegas, NV (United States)); Baker, N.A.; Duguid, J.O. TRW Environmental Safety Systems, Inc., Las Vegas, NV (United States); INTERA, Inc., Las Vegas, NV (United States). 4 Apr 1994. 321p. Sponsored

by USDOE, Washington, DC (United States). DOE Contract AC01-91RW00134. Order Number DE94015954. Source: OSTI; NTIS; INIS; GPO Dep.

Since the 1960's, ground-water flow models have been used for analysis of water resources problems. In the 1970's, emphasis began to shift to analysis of waste management problems. This shift in emphasis was largely brought about by site selection activities for geologic repositories for disposal of high-level radioactive wastes. Model development during the 1970's and well into the 1980's focused primarily on saturated ground-water flow because geologic repositories in salt, basalt, granite, shale, and tuff were envisioned to be below the water table. Selection of the unsaturated zone at Yucca Mountain, Nevada, for potential disposal of waste began to shift model development toward unsaturated flow models. Under the US Department of Energy (DOE), the Civilian Radioactive Waste Management System Management and Operating Contractor (CRWMS M&O) has the responsibility to review, evaluate, and document existing computer models; to conduct performance assessments; and to develop performance assessment models, where necessary. This document describes the CRWMS M&O approach to model review and evaluation (Chapter 2), and the requirements for unsaturated flow models which are the bases for selection from among the current models (Chapter 3). Chapter 4 identifies existing models, and their characteristics. Through a detailed examination of characteristics, Chapter 5 presents the selection of models for testing. Chapter 6 discusses the testing and verification of selected models. Chapters 7 and 8 give conclusions and make recommendations, respectively. Chapter 9 records the major references for each of the models reviewed. Appendix A, a collection of technical reviews for each model, contains a more complete list of references. Finally, Appendix B characterizes the problems used for model testing.

27455 (EGG-CIET–11057) **Ecological survey for the siting of the Mixed and Low-Level Waste Treatment Facility and the Idaho Waste Processing Facility.** Hoskinson, R.L. EG and G Idaho, Inc., Idaho Falls, ID (United States). May 1994. 34p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE94015317. Source: OSTI; NTIS; INIS; GPO Dep.

This report summarizes the results of field ecological surveys conducted by the Center for Integrated Environmental Technologies (CIET) on the Idaho National Engineering Laboratory (INEL) at four candidate locations for the siting of the Mixed and Low-Level Waste Treatment Facility (MLLWTF) and the Idaho Waste Processing Facility (IWPF). The purpose of these surveys was to comply with all Federal laws and Executive Orders to identify and evaluate any potential environmental impacts because of the project. The boundaries of the candidate location were marked with blaze-orange lath survey marker stakes by the project management. Global Positioning System (GPS) measurements of the marker stakes were made, and input to the Arc/Info® geographic information system (GIS). Field surveys were conducted to assess any potential impact to any important species, important habitats, and to any environmental study areas. The GIS location data was overlayed onto the INEL vegetation map and an analysis of vegetation classes on the locations was done. Results of the field surveys indicate use of Candidate Location #1 by pygmy rabbits (Sylvilagus idahoensis) and expected use by them of Candidate Locations #3 and #9. Pygmy rabbits are categorized as a C2 species by the US Fish and Wildlife Service (USFWS). Two other C2 species, the ferruginous hawk (Buteo regalis) and the loggerhead shrike (Lanius ludovicianus) would also be expected to frequent the candidate locations. Candidate Location #5 at the north end of the INEL is in the winter range of a large number of pronghorn antelope (Antilocapra americana).

27456 (EGG-CIET–11058) **Ecological survey for the siting of the Mixed and Low-Level Waste Disposal Facility.** Hoskinson, R.L. EG and G Idaho, Inc., Idaho Falls, ID (United States). May 1994. 24p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE94015320. Source: OSTI; NTIS; INIS; GPO Dep.

This report summarizes the results of field ecological surveys conducted by the Center for Integrated Environmental Technologies (CIET) on the Idaho National Engineering Lab. (INEL) at two candidate locations for the siting of the Mixed and Low-Level Waste Disposal Facility (MLLWDF). The purpose of these surveys was to comply with all Federal laws and Executive Orders to identify and evaluate any potential environmental impacts because of the project. The boundaries of the candidate locations were marked with blaze-orange lath survey marker stakes by the project management. Global Positioning in System (GPS) measurements of the marker stakes were made, and input to the Arc/Info geographic information system (GIS). Field surveys were conducted to assess any potential impact to any important species, important habitats, and to any environmental study areas. The GIS location data were overlayed onto the INEL vegetation map and an analysis of vegetation classes on the locations was done. Two species of rare vascular plants have previously been reported to occur in the vicinity of the candidate locations. Two C2 species, the ferruginous hawk (Buteo regalis) and the loggerhead shrike (Lanius ludovicianus) would also be expected to frequent the candidate locations. No significant ecological impact is anticipated if the MLLWDF were constructed on either candidate location. However, both candidate locations are in the central area of the INEL where there is minimal disturbance to the ecosystem by facilities or humans.

27457 (EGG-WROC–11148) **Hazards assessment for the Hazardous Waste Storage Facility.** Knudsen, J.K.; Calley, M.B. EG and G Idaho, Inc., Idaho Falls, ID (United States). Apr 1994. 75p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE94015321. Source: OSTI; NTIS; INIS; GPO Dep.

This report documents the hazards assessment for the Hazardous Waste Storage Facility (HWSF) located at the Idaho National Engineering Laboratory. The hazards assessment was performed to ensure that this facility complies with DOE and company requirements pertaining to emergency planning and preparedness for operational emergencies. The hazards assessment identifies and analyzes hazards that are significant enough to warrant consideration in a facility's operational emergency management program. The area surrounding HWSF, the buildings and structures at HWSF, and the processes used at HWSF are described in this report. All nonradiological hazardous materials at the HWSF were identified (radiological hazardous materials are not stored at HWSF) and screened against threshold quantities according to DOE Order 5500.3A guidance. Two of the identified hazardous materials exceeded their specified threshold quantity. This report discusses the potential release scenarios and consequences associated with an accidental release for each of the two identified hazardous materials, lead and mercury. Emergency considerations, such as emergency planning zones, emergency classes, protective actions, and emergency action levels, are also discussed based on the analysis of potential consequences. Evaluation of the potential consequences indicated that the highest emergency class for operational emergencies at the HWSF would be a Site Area Emergency.

27458 (FRCEA-TH–420) **Thermal denitrification of evaporators concentrates in reactor with fluidized bed.** Brugnot, C. CEA Centre d'Etudes de Cadarache, 13 - Saint-Paul-lez-Durance (France). Dept. Stockage Dechets; Institut National Polytechnique, 31 - Toulouse (France). Nov 1993. 314p. (In French). Order Number DE94632357. Source: OSTI; NTIS (US Sales Only); INIS.

As part of the treatments of liquid wastes coming from the Marcoule reprocessing plant, the study of a thermal denitrification process for evaporator concentrates has been chosen by the CEA/CEN Cadarache: the fluidized-bed calcination. This work presents the study of a calcination pilot-plant for wastes with a very high sodium nitrate content. After a reactional analysis carried out in a thermobalance on samples which are representative of the fluidized-bed compounds, the perfecting of many of the plant parameters - such as the solution injection system - was carried out on a scale-model at first. Then, it was verified on the pilot-plant, and some experiments have been carried out. A mathematical model for the particle growth inside the fluidized-bed is proposed. (author). 179 refs., 65 figs., 23 tabs.

27459 (LA–12795-MS) **Radionuclide concentrations in elk that winter on Los Alamos National Laboratory lands.** Fresquez,

P.R.; Armstrong, D.A.; Salazar, J.G. Los Alamos National Lab., NM (United States). Jul 1994. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. Order Number DE94015564. Source: OSTI; NTIS; INIS; GPO Dep.

Elk spend the winter in areas at Los Alamos National Laboratory (LANL) that may contain radioactivity above natural and/or worldwide fallout levels. This study was initiated to determine the levels of ^{90}Sr, ^{137}Cs, ^{238}Pu, ^{239}Pu, and total uranium in various tissues (brain, hair, heart, jawbone, kidneys, leg bone, liver, and muscle) of adult cow elk that use LANL lands during the fall/winter months. No significant differences in radionuclide contents were detected in any of the tissue samples collected from elk on LANL lands as compared with elk collected from off-site locations. The total effective (radiation) dose equivalent a person would receive from consuming 3.2 lb of heart, 5.6 lb of liver, and 226 lb of muscle from elk that winter on LANL lands, after natural background has been subtracted, was 0.00008, 0.0001, and 0.008 mrem/yr, respectively. The highest dose was less than 0.01% of the International Commission of Radiological Protection permissible dose limit for protecting the public.

27460 (NUREG–0837-Vol.14-No.1) **NRC TLD Direct Radiation Monitoring Network: Progress report, January–March 1994: Volume 14, Number 1.** Struckmeyer, R. Nuclear Regulatory Commission, King of Prussia, PA (United States). Region I. Jun 1994. 226p. Sponsored by Nuclear Regulatory Commission, Washington, DC (United States). Source: OSTI; NTIS; INIS; GPO.

The US Nuclear Regulatory Commission (NRC) Direct Radiation Monitoring Network is operated by the NRC in cooperation with participating states to provide continuous measurement of the ambient radiation levels around licensed NRC facilities, primarily power reactors. Ambient radiation levels results from naturally occurring radionuclides present in the soil, cosmic radiation constantly bombarding the earth from outer space, and the contribution, if any, from the monitored facilities and other man-made sources. The Network is intended to measure radiation levels during routine facility operations and to establish background radiation levels used to assess the radiological impact of an unusual condition, such as an accident. This report presents the radiation levels measured around all facilities in the Network for the first quarter of 1994. A complete listing of the site facilities monitored is included. All radiation measurements are made using small, passive detector called thermoluminescent dosimeters (TLDs), which provide a quantitative measurements of the radiation levels in the area in which they are placed.

27461 (ORNL–6784) **Environmental Sciences Division annual progress report for period ending September 30, 1993.** Oak Ridge National Lab., TN (United States). May 1994. 328p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE94015515. Source: OSTI; NTIS; INIS; GPO Dep.

Environmental Sciences Division Publication Number 4211.

This progress report summarizes the research and development activities conducted in the Environmental Sciences Division (ESD) of Oak Ridge National Laboratory during fiscal year (FY) 1993, which extended from October 1, 1992, through September 30, 1993. The report is structured to provide descriptions of current activities and accomplishments in each of the division's major organizational units. Following the sections describing the organizational units are sections highlighting ESD Scientific, Technical, and Administrative Achievement awards and listing information necessary to convey the scope of the work in the division. An organizational chart of staff and long-term guests who were in ESD and the end of FY 1993 is located in the final section of the report.

27462 (WHC-SA–2278) **Dose assessment for potential radionuclide emissions from stacks on the Hanford Site: NESHAP compliance.** Davis, W.E. (Westinghouse Hanford Co., Richland, WA (United States)); Barnett, J.M.; Kenoyer, J.L. Westinghouse Hanford Co., Richland, WA (United States). Mar 1994. 14p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-940499–12: Federal environmental restoration and waste minimization conference and exhibition, New Orleans, LA (United States), 25-29 Apr 1994). Order Number DE94016321. Source: OSTI; NTIS; INIS; GPO Dep.

The purpose of this document is to present the assessment results for the registered stacks on the Hanford Site for potential emissions, i.e. emissions with no control devices in place. Further, the document will identify those stacks requiring continuous monitoring, i.e. the effective dose equivalent from potential emissions >0.1 mrem/yr. The stack assessment of potential emissions was performed on 84 registered stacks on the Hanford Site. These emission sources represent individual point sources presently registered under Washington Administrative code 246-247 with the Washington Department of Health. The methods used in assessing the potential emissions from the stacks are described.

27463 (WHC-SA–2526) **Potential radionuclide emissions from stacks on the Hanford Site: Part 1: Dose assessment.** Davis, W.E.; Barnett, J.M. Westinghouse Hanford Co., Richland, WA (United States). Jun 1994. 12p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-940738–2: 23. DOE/NRC nuclear air cleaning and treatment conference, Buffalo, NY (United States), 25-28 Jul 1994). Order Number DE94015377. Source: OSTI; NTIS; INIS; GPO Dep.

On February 3, 1993, the US Department of Energy, Richland Operations Office (RL) received a Compliance Order and Information Request from the Director of the Air and Toxics Division of the US Environmental Protection Agency (EPA), Region 10. The Compliance Plan specified that a dose assessment would be performed for 84 Westinghouse Hanford Company (WHC) stacks registered with the Washington State Department of Health (WAC 246-247) on the Hanford Site. Stacks that have the potential emissions to cause an effective dose equivalent (EDE) to a maximum exposed individual (MEI) greater than 0.1 mrem y^{-1} must be monitored continuously for radionuclide emissions. Five methods were approved by EPA, Region 10 for performing the assessments: Release Fractions from Appendix D of 40 CFR 61, Back Calculations Using A HEPA Filtration Factor, Nondestructive Assay of HEPA Filters, A Spill Release Fraction, and Upstream of HEPA Filter Air Concentrations. The first two methods were extremely conservative for estimating releases. The third method which used a state-of-the-art portable gamma spectrometer, yielded surprising results from the distribution of radionuclides on the HEPA filters. All five methods are described.

27464 (WHC-SD-EN-DP–089) **Aquifer testing data package for 1993 200-UP-1 Groundwater Operable Unit.** Swanson, L.C. Westinghouse Hanford Co., Richland, WA (United States). 24 Jun 1994. 218p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE94015337. Source: OSTI; NTIS; INIS; GPO Dep.

The following aquifer testing data supported 1993 Interim Remedial Measure field work for the U-1 and U-2 crib area near the uranium technetium and nitrate plumes beneath the U Plant Aggregate Area. The purpose of aquifer testing was to fill in hydraulic conductivity data gaps in the western portion of 200 West Area and help refine the hydrogeologic conceptual model. This data package reports data collected in accordance with the description of work released in 1993 by L.C. Swanson, entitled Description of Work for the 200-UP-1 Aquifer Testing Activity. These data are analyzed in the document Aquifer Test Analysis Results for 1993 200-UP-1 Groundwater Operable Unit. Slug tests were conducted at 7 existing wells, and pumping tests were conducted at 2 of those same existing wells.

27465 (WHC-SD-EN-TI–217) **Geophysical investigation of burn pit, 128-H-1, 100-H Area.** Szwartz, G.J. Westinghouse Hanford Co., Richland, WA (United States). 11 Jul 1994. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE94015740. Source: OSTI; NTIS; INIS; GPO Dep.

The 128-H-1 burn pit is located in the northeast corner of 100-H Area. The objective of the survey was to delineate subsurface features in the 128-H-1 burn pit that may affect the emplacement of soil-gas probes. Ground-penetrating radar (GPR) and electromagnetic induction (EMI) were the two techniques used in the investigation. The methods were selected because they are non-intrusive, relatively fast, economical, and have been used successfully in other geophysical investigations on the Hanford Site. The GPR system used for this work utilized a 300-MHz antenna to

transmit the Em energy into the ground. The transmitted energy is reflected back to a receiving antenna where variations in the return signal are recorded. Common reflectors include natural geologic conditions such as bedding, cementation, moisture, and clay, or man-made objects such as pipes, barrels, foundations, and buried wires. The studied depth, which varies from site to site, was 0–11 ft for this survey. The method is limited in depth by transmit power, receiver sensitivity, and attenuation of the transmitted energy. Depth of investigation is influenced by highly conductive material, such as metal drums, which reflect all the energy back to the receiver. Therefore, the method cannot "see" below such objects.

27466 (WHC-SD-EN-TI–230) **Geophysical survey for proposed borehole 199-K-106A, 100-K Area.** Mitchell, T.H. Westinghouse Hanford Co., Richland, WA (United States). 8 Jul 1994. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE94015741. Source: OSTI; NTIS; INIS; GPO Dep.

The objective of the survey was to locate subsurface obstructions that may affect the drilling of proposed borehole, 199-K-106A, about 50 ft east of the 1,714 KW Building, 100-K Area. Based upon the results of the survey, possible drill sites within the zone, with the least likelihood of encountering identified obstructions, were identified. The ground-penetrating radar (GPR) system used for this work utilized a 300-megahertz antenna to transmit the electromagnetic (EM) energy into the ground. The transmitted energy is reflected back to a receiving antenna where variations in the return signal are recorded. Common reflectors include natural geologic conditions such as bedding, cementation, moisture, and clay, or man-made objects such as pipes, barrels, foundations, and buried wires. The method is limited in depth by transmit power, receiver sensitivity, frequency, and attenuation of the transmitted energy which can be strongly affected by geology. Depth of investigation is also influenced by highly conductive material, such as metal drums, which reflect all the energy back to the receiver. Therefore, the method cannot "see" below such objects. Maximum depth of penetration for this survey seemed to be about 10 to 12 ft.

27467 (WHC-SD-EN-TI–267) **Data validation report for the 100-HR-3 Operable Unit first quarter 1994 groundwater sampling data.** Biggerstaff, R.L. Westinghouse Hanford Co., Richland, WA (United States). 24 Jun 1994. 128p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE94015645. Source: OSTI; NTIS; INIS; GPO Dep.

Westinghouse-Hanford has requested that a minimum of 20% of the total number of Sample Delivery Groups be validated for the 100-HR-3 Operable Unit First Quarter 1994 Groundwater Sampling Investigation. Therefore, the data from the chemical analysis of twenty-four samples from this sampling event and their related quality assurance samples were reviewed and validated to verify that reported sample results were of sufficient quality to support decisions regarding remedial actions performed at this site. The samples were analyzed by Thermo-Analytic Laboratories (TMA) and Roy F. Weston Laboratories (WESTON) using US Environmental Protection Agency (EPA) CLP protocols. Sample analyses included: inorganics; and general chemical parameters. Forty-two samples were validated for radiochemical parameters by TMA and Teledyne.

27468 (WSRC-MS–94-065(P)) **Real-time aqueous tritium monitor using liquid scintillation counting.** Sigg, R.A.; McCarty, J.E.; Livingston, R.R.; Sanders, M.A. Westinghouse Savannah River Co., Aiken, SC (United States). [1994]. 12p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035. (CONF-940524–11: 8. symposium on radiation measurements and applications, Ann Arbor, MI (United States), 16-19 May 1994). Order Number DE94014647. Source: OSTI; NTIS; GPO Dep.

An ability to continuously monitor low-level tritium releases in aqueous effluents is of particular interest to heavy water facilities such as those at the Savannah River Site (SRS) and Canadian CANDU reactors. SRS developed a real-time monitoring system based on flow-through liquid scintillation (LS) counting. Sensitivities of 16 pCi/mL and 1 pCi/mL result from five minute and daily averages of counting data respectively. This sensitivity is about 200 times better than similar methods using solid scintillants. The LS system features uncomplicated sample pretreatment, precise of the cocktail and sample water, system features uncomplicated sample pretreatment, precise proportioning of the cocktail and sample water, on-line quench corrections, cocktail consumption as low as 0.15 mL/min, and response to changes in environmental tritium is less than 30 minutes. Field tests demonstrate that conditions necessary for stable analytical results are achieved.

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Refer also to citation(s) 27272, 27277, 27278, 27296, 27300, 27302, 27303, 27305, 27338, 27339, 27343, 27351, 27352, 27354, 27356, 27382, 27384, 27386, 27391, 27392, 27399, 27406, 27408, 27409, 27411, 27412, 27413, 27414, 27415, 27417, 27423, 27432, 27433, 27435, 27438, 27439, 27440, 27443, 27444, 27445, 27451, 27452, 27466, 28015, 28033, 28328, 28373, 28487, 28508, 28519, 28886, 28893, 28961, 28966, 28969

27469 (BNL–49873) **Off-gas recycle for long-term low temperature gas phase uranium decontamination.** Bundy, R.D.; Bunch, D.H.; Munday, E.B.; Simmons, D.W. Oak Ridge K-25 Site, TN (United States). [1994]. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OT21400. (CONF-940853–1: Summer meeting of the American Institute of Chemical Engineers, Denver, CO (United States), 14-17 Aug 1994). Order Number DE94015149. Source: OSTI; NTIS; GPO Dep.

In situ long-term low-temperature (LTLT) gas phase decontamination is being developed and demonstrated at the K-25 site as a technology that has the potential to substantially lower these costs while reducing criticality and safeguards concerns and worker exposure to hazardous and radioactive materials. The objective of gas phase decontamination is to employ a gaseous reagent to fluorinate nonvolatile uranium deposits to form volatile UF_6, which can be recovered by chemical trapping or freezing. The LTLT process permits the decontamination of the inside of gas-tight GDP process equipment at room temperature by substituting a long exposure to subatmospheric ClF_3 for higher reaction rates at higher temperatures. Laboratory-scale experiments have demonstrated the feasibility of using LTLT gas phase decontamination with ClF_3 to remove uranium deposits from this equipment. A mobile gas phase system is being designed to demonstrate the decontamination process on a full scale. If used to decontaminate the GDPs, the LTLT process would use large amounts of ClF_3 and exhaust large volumes of by-product gases (ClF, ClO_2F, etc.). Initially, the excess ClF_3 and reaction byproducts will be destroyed in a KOH scrubber. This paper describes a proposed system that could recover the excess $ClF_3$and regenerate the reaction by-products into ClF_3 for use in decontamination of additional equipment. Use of this regeneration and recovery system would reduce raw material costs and also reduce the waste scrubber sludge disposal costs by reducing the amount of corrosive gases fed to the scrubber.

27470 (DOE/EA–0877) **Operable Unit 3: Proposed Plan/ Environmental Assessment for interim remedial action.** USDOE Fernald Field Office, OH (United States). Dec 1993. 278p. Sponsored by USDOE, Washington, DC (United States). Order Number DE94017169. Source: OSTI; NTIS; INIS; GPO Dep.

This document presents a Proposed Plan and an Environmental Assessment for an interim remedial action to be undertaken by the US Department of Energy (DOE) within Operable Unit 3 (OU3) at the Fernald Environmental Management Project (FEMP). This proposed plan provides site background information, describes the remedial alternatives being considered, presents a comparative evaluation of the alternatives and a rationnale for the identification of DOE's preferred alternative, evaluates the potential environmental and public health effects associated with the alternatives, and outlines the public's role in helping DOE and the EPA to make the final decision on a remedy.

27471 (DOE/EH–0353P) **OSH technical reference manual.** USDOE Assistant Secretary for Environment, Safety, and Health, Washington, DC (United States). Nov 1993. 201p. Sponsored by USDOE, Washington, DC (United States). Order Number DE94016016. Source: OSTI; NTIS; GPO Dep.

In an evaluation of the Department of Energy (DOE) Occupational Safety and Health programs for government-owned contractor-operated (GOCO) activities, the Department of Labor's Occupational Safety and Health Administration (OSHA) recommended a technical information exchange program. The intent was to share written safety and health programs, plans, training manuals, and materials within the entire DOE community. The OSH Technical Reference (OTR) helps support the secretary's response to the OSHA finding by providing a one-stop resource and referral for technical information that relates to safe operations and practice. It also serves as a technical information exchange tool to reference DOE-wide materials pertinent to specific safety topics and, with some modification, as a training aid. The OTR bridges the gap between general safety documents and very specific requirements documents. It is tailored to the DOE community and incorporates DOE field experience.

27472 (DOE/EH–94016136) **DOE interpretations Guide to OSH standards: Update to the Guide.** Occupational Safety and Health Administration, Washington, DC (United States). 31 Mar 1994. 838p. Sponsored by USDOE, Washington, DC (United States). Order Number DE94016136. Source: OSTI; NTIS; GPO Dep.

Reflecting Secretary O'Leary's focus on occupational safety and health, the Office of Occupational Safety is pleased to provide you with the latest update to the DOE Interpretations Guide to OSH Standards. This Guide was developed in cooperation with the Occupational Safety and Health Administration, which continued its support during this last revision by facilitating access to the interpretations found on the OSHA Computerized Information System (OCIS). This March 31, 1994 update contains 123 formal interpretation letters written by OSHA. As a result of the unique requests received by the 1-800 Response Line, this update also contains 38 interpretations developed by DOE. This new occupational safety and health information adds still more important guidance to the four volume reference set that you presently have in your possession.

27473 (DOE/EH–94016137) **DOE interpretations Guide to OSH standards: Update to the Guide.** Occupational Safety and Health Administration, Washington, DC (United States). 31 Mar 1994. 837p. Sponsored by USDOE, Washington, DC (United States). Order Number DE94016137. Source: OSTI; NTIS; GPO Dep.

Reflecting Secretary O'Leary's focus on occupational safety and health, the Office of Occupational Safety is pleased to provide you with the latest update to the DOE Interpretations Guide to OSH Standards. This Guide was developed in cooperation with the Occupational Safety and Health Administration, which continued its support during this last revision by facilitating access to the interpretations found on the OSHA Computerized Information System (OCIS). This March 31, 1994 update contains 123 formal interpretation letters written OSHA. As a result of the unique requests received by the 1-800 Response Line, this update also contains 38 interpretations developed by DOE. This new occupational safety and health information adds still more important guidance to the four volume reference set that you presently have in your possession.

27474 (DOE/EH–94016138) **DOE interpretations Guide to OSH standards: Update to the Guide.** Occupational Safety and Health Administration, Washington, DC (United States). 31 Mar 1994. 794p. Sponsored by USDOE, Washington, DC (United States). Order Number DE94016138. Source: OSTI; NTIS; GPO Dep.

Reflecting Secretary O'Leary's focus on occupational safety and health, the Office of Occupational Safety is pleased to provide you with the latest update to the DOE Interpretations Guide to OSH Standards. This Guide was developed in cooperation with the Occupational Safety and Health Administration, which continued its support during this last revision by facilitating access to the interpretations found on the OSHA Computerized Information System (OCIS). This March 31, 1994 update contains 123 formal interpretation letters written by OSHA. As a result of the unique requests received by the 1-800 Response Line, this update also contains 38 interpretations developed by DOE. This new occupational safety and health information adds still more important guidance to the four volume reference set that you presently have in your possession.

27475 (DOE/EH–94016139) **DOE interpretations Guide to OSH standards: Update to the Guide.** Occupational Safety and Health Administration, Washington, DC (United States). 31 Mar 1994. 404p. Sponsored by USDOE, Washington, DC (United States). Order Number DE94016139. Source: OSTI; NTIS; GPO Dep.

Reflecting Secretary O'Leary's focus on occupational safety and health, the Office of Occupational Safety is pleased to provide you with the latest update to the DOE Interpretations Guide to OSH Standards. This Guide was developed in cooperation with the Occupational Safety and Health Administration, which continued it's support during this last revision by facilitating access to the interpretations found on the OSHA Computerized Information System (OCIS). This March 31, 1994 update contains 123 formal in letter written by OSHA. As a result of the unique requests received by the 1-800 Response Line, this update also contains 38 interpretations developed by DOE. This new occupational safety and health information adds still more important guidance to the four volume reference set that you presently have in your possession.

27476 (DOE/MWIP–27) **Preliminary hazards analysis – vitrification process.** Coordes, D. (Science Applications International Corp., Pleasanton, CA (United States)); Ruggieri, M.; Russell, J.; TenBrook, W.; Yimbo, P. Lawrence Livermore National Lab., CA (United States); Science Applications International Corp., Pleasanton, CA (United States). Jun 1994. 114p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (UCRL-CR–116576). Order Number DE94016453. Source: OSTI; NTIS; INIS; GPO Dep.

This paper presents a Preliminary Hazards Analysis (PHA) for mixed waste vitrification by joule heating. The purpose of performing a PHA is to establish an initial hazard categorization for a DOE nuclear facility and to identify those processes and structures which may have an impact on or be important to safety. The PHA is typically performed during and provides input to project conceptual design. The PHA is then followed by a Preliminary Safety Analysis Report (PSAR) performed during Title 1 and 2 design. The PSAR then leads to performance of the Final Safety Analysis Report performed during the facility's construction and testing. It should be completed before routine operation of the facility commences. This PHA addresses the first four chapters of the safety analysis process, in accordance with the requirements of DOE Safety Guidelines in SG 830.110. The hazards associated with vitrification processes are evaluated using standard safety analysis methods which include: identification of credible potential hazardous energy sources; identification of preventative features of the facility or system; identification of mitigative features; and analyses of credible hazards. Maximal facility inventories of radioactive and hazardous materials are postulated to evaluate worst case accident consequences. These inventories were based on DOE-STD-1027-92 guidance and the surrogate waste streams defined by Mayberry, et al. Radiological assessments indicate that a facility, depending on the radioactive material inventory, may be an exempt, Category 3, or Category 2 facility. The calculated impacts would result in no significant impact to offsite personnel or the environment. Hazardous materials assessment indicates that a Mixed Waste Vitrification facility will be a Low Hazard facility having minimal impacts to offsite personnel and the environment.

27477 (DOE/OR–01-1194-D2) **Site characterization plan for groundwater in Waste Area Grouping 1 at Oak Ridge National Laboratory, Oak Ridge, Tennessee.** Lee, R.R.; Curtis, A.H.; Houlberg, L.M.; Purucker, S.T.; Singer, M.L.; Tardiff, M.F.; Wolf, D.A. Oak Ridge National Lab., TN (United States). Jul 1994. 285p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. (ORNL/ER–191-D2). Order Number DE94015940. Source: OSTI; NTIS; INIS; GPO Dep.

The Waste Area Grouping (WAG) 1 Groundwater Operable Unit (OU) at Oak Ridge National Laboratory (ORNL) in Oak Ridge, Tennessee, is undergoing a site characterization to identify environmental contamination that may be present. This document, Site Characterization Report for Groundwater in Waste Area Grouping I

at Oak Ridge National Laboratory, Oak Ridge, Tennessee, identifies areas of concern with respect to WAG 1 groundwater and presents the rationale, justification, and objectives for conducting this continuing site characterization. This report summarizes the operations that have taken place at each of the areas of concern in WAG 1, summarizes previous characterization studies that have been performed, presents interpretations of previously collected data and information, identifies contaminants of concern, and presents an action plan for further site investigations and early actions that will lead to identification of contaminant sources, their major groundwater pathways, and reduced off-site migration of contaminated groundwater to surface water. Site characterization Activities performed to date at WAG I have indicated that groundwater contamination, principally radiological contamination, is widespread. An extensive network of underground pipelines and utilities have contributed to the dispersal of contaminants to an unknown extent. The general absence of radiological contamination in surface water at the perimeter of WAG 1 is attributed to the presence of pipelines and underground waste storage tank sumps and dry wells distributed throughout WAG 1 which remove more than about 40 million gal of contaminated groundwater per year.

27478 (DOE/OR–01-1252-D1) **Remedial investigation work plan for the Groundwater Operable Unit at Oak Ridge National Laboratory, Oak Ridge, Tennessee.** Oak Ridge National Lab., TN (United States); Science Applications International Corp., Oak Ridge, TN (United States). Mar 1994. 342p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. (ORNL/ER–221-D1). Order Number DE94015937. Source: OSTI; NTIS; INIS; GPO Dep.

This Remedial Investigation (RI) Work Plan has been developed as part of the US Department of Energy's (DOE's) investigation of the Groundwater Operable Unit (GWOU) at Oak Ridge National Laboratory (ORNL) located near Oak Ridge, Tennessee. The first iteration of the GWOU RI Work Plan is intended to serve as a strategy document to guide the ORNL GWOU RI. The Work Plan provides a rationale and organization for groundwater data acquisition, monitoring, and remedial actions to be performed during implementation of environmental restoration activities associated with the ORNL GWOU. It Is important to note that the RI Work Plan for the ORNL GWOU is not a prototypical work plan. The RI will be conducted using annual work plans to manage the work activities, and task reports will be used to document the results of the investigations. Sampling and analysis results will be compiled and reported annually with a review of data relative to risk (screening level risk assessment review) for groundwater. This Work Plan outlines the overall strategy for the RI and defines tasks which are to be conducted during the initial phase of investigation. This plan is presented with the understanding that more specific addenda to the plan will follow.

27479 (DOE/RL–90-21) **Remedial investigation/feasibility study work plan for the 100-KR-4 operable unit, Hanford Site, Richland, Washington.** USDOE Richland Operations Office, WA (United States). Sep 1992. 404p. Sponsored by USDOE, Washington, DC (United States). Order Number DE94016324. Source: OSTI; NTIS; INIS; GPO Dep.

Four areas of the Hanford Site (the 100, 200, 300, and 1100 Areas) have been included on the US Environmental Protection Agency's (EPA's) National Priorities List (NPL) under the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA). This work plan and the attached supporting project plans establish the operable unit setting and the objectives, procedures, tasks, and schedule for conducting the CERCLA remedial investigation/feasibility study (RI/FS) for the 100-KR-4 operable unit. The 100-K Area consists of the 100-KR-4 groundwater operable unit and three source operable units. The 100-KR-4 operable unit includes all contamination found in the aquifer soils and water beneath the 100-K Area. Source operable units include facilities and unplanned release sites that are potential sources of contamination.

27480 (DOE/RL–93-29) **Limited field investigation report for the 100-DR-1 Operable Unit.** USDOE Richland Operations Office, WA (United States). Jun 1994. 244p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE94015670. Source: OSTI; NTIS; INIS; GPO Dep.

This limited field investigation (LFI) report summarizes the data collection and analysis activities conducted during the 100-DR-1 Source Operable Unite LFI and the associated qualitative risk assessment (QRA), and makes recommendations on the continued candidacy of high-priority sites for interim remedial measures (IRM). The results and recommendations presented in this report are generally independent of future land use scenarios. The 100-DR-1 Operable Unit is one of four operable units associated with the 100 D/DR Area at the Hanford Site. The 100-DR-1 Operable Unit encompasses approximately 1.5 km^2 (0.59 mi^2) and is located immediately adjacent to the Columbia River shoreline. In general, it contains waste facilities associated with the original plant facilities constructed to support D Reactor facilities, as well as cooling water retention basin systems for both D and DR Reactors. The 100-DR-1 LFI began the investigative phase of the remedial investigation for a select number of high-priority sites. The LFI was performed to provide additional data needed to support selection, design and implementation of IRM, if needed. The LFI included data compilation, nonintrusive investigations, intrusive investigations, summarization of 100 Area aggregate studies, and data evaluation.

27481 (DOE/RL/10930–T2) **Message development for surface markers at the Hanford Radwaste Disposal sites.** Kaplan, M.F. Rockwell International Corp., Richland, WA (United States). Rockwell Hanford Operations; Analytic Sciences Corp., Reading, MA (United States). 31 Dec 1984. 57p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (TR–5146-1). Order Number DE94016326. Source: OSTI; NTIS; GPO Dep.

At the Hanford Reservation in Washington, there are sites which received liquid and solid transuranic wastes from the late 1940's until 1970. Rockwell Hanford Operations (Rockwell) is investigating the feasibility of several options for the permanent disposal of these wastes. One option is to stabilize the wastes in their present locations and to add barriers to minimize water infiltration and root penetration into the wastes. This report forms part of the project to develop a marking system for transuranic wastes on the Hanford Reservation. The focus of this report is the development of the message system to appear on the surface markers. A logical framework is developed to deduce what is required by the message system. Alternatives for each message component are evaluated and justification is provided for the choice of each component. The components are then laid out on the surface marker to provide a legible, comprehensible message system. The surface markers are tall, standing monoliths which ring the perimeter of each disposal area. Based on the logical framework, it is recommended that three domains of representation – symbols, pictures, and language – be used in the message system. The warning symbol chosen for the message system is the radiation trefoil. Two other options were considered, including the warning symbol developed by the Human Interference Task Force for a high-level waste repository. The trefoil was preferred because of the widespread usage and international acceptance which is already enjoys.

27482 (DPSTSA–200-10-Suppl.4-Del.Ver.) **Safety analysis – 200 Area Savannah River Plant, F-Canyon Operations: Supplement 4.** Beary, M.M.; Collier, C.D.; Fairobent, L.A.; Graham, R.F.; Mason, C.L.; McDuffee, W.T.; Owen, T.L.; Walker, D.H. Science Applications International Corp., San Diego, CA (United States). Feb 1986. 395p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035. Order Number DE94015634. Source: OSTI; NTIS; GPO Dep.

The F-Canyon facility is located in the 200 Separations Area and uses the Purex process to recover plutonium from reactor-irradiated uranium. The irradiated uranium is normally in the form of solid or hollow cylinders called slugs. These slugs are encased in aluminum cladding and are sent to the F-Canyon from the Savannah River Plant (SRP) reactor areas or from the Receiving Basin for Offsite Fuels (RBOF). This Safety Analysis Report (SAR) documents an analysis of the F-Canyon operations and is an update to a section of a previous SAR. The previous SAR documented an analysis of the entire 200 Separations Area operations. This SAR documents an analysis of the F-Canyon and is one of a

series of documents for the Separations Area as specified in the Savannah River Implementation Plans. A substantial amount of the information supporting the conclusions of this SAR is found in the Systems Analysis. Some F-Canyon equipment has been updated during the time between the Systems Analysis and this SAR and a complete description of this equipment is included in this report. The primary purpose of the analysis was to demonstrate that the F-Canyon can be operated without undue risk to onsite or offsite populations and to the environment. In this report, risk is defined as the expected frequency of an accident, multiplied by the resulting radiological consequence in person-rem. The units of risk for radiological dose are person-rem/year. Maximum individual exposure values have also been calculated and reported.

27483 (DPW–55-131) **Radioactivity of the U-233 product and the recovered thorium.** Jenkins, W.A.; Menegus, R.L. Du Pont de Nemours (E.I.) and Co., Wilmington, DE (United States). Explosives Dept. 18 Feb 1955. 26p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-76SR00001. (SR/H–721). Order Number DE94011765. Source: OSTI; NTIS (US Sales Only); GPO Dep.

Thorium is to be exposed in the reactor for the purpose of producing large quantities of U-233. Side reactions with thorium and with intermediate products produce small quantities of U-232, Th-228, and Th-234, all of which are radioactive. The U-232 produced by the fast neutron flux in the reactors decays to Th-228, which in turn liberates energetic gamma rays during its decay. Thorium-228 grows in during irradiation and pre-separation cooling, and it contributes most of the activity in the purified thorium. Since this activity is cumulative over several irradiation cycles, a radiological health hazard is encountered in handling the purified thorium. Furthermore, sine U-232 decays to Th-228 after separation, the purified product U-233 also becomes radioactive. Health hazards are similarly encountered in handling this product. This report gives estimates of the magnitudes of these hazards.

27484 (EGG-WM–8773) **Radioactive Waste Management Complex low-level waste radiological performance assessment.** Maheras, S.J.; Rood, A.S.; Magnuson, S.O.; Sussman, M.E.; Bhatt, R.N. EG and G Idaho, Inc., Idaho Falls, ID (United States). Apr 1994. 458p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE94016278. Source: OSTI; NTIS; INIS; GPO Dep.

This report documents the projected radiological dose impacts associated with the disposal of radioactive low-level waste at the Radioactive Waste Management Complex at the Idaho National Engineering Laboratory. This radiological performance assessment was conducted to evaluate compliance with applicable radiological criteria of the US Department of Energy and the US Environmental Protection Agency for protection of the public and the environment. The calculations involved modeling the transport of radionuclides from buried waste, to surface soil and subsurface media, and eventually to members of the public via air, groundwater, and food chain pathways. Projections of doses were made for both offsite receptors and individuals inadvertently intruding onto the site after closure. In addition, uncertainty and sensitivity analyses were performed. The results of the analyses indicate compliance with established radiological criteria and provide reasonable assurance that public health and safety will be protected.

27485 (EGG-WTD–11161) **La-oxides as tracers for PuO_2 to simulate contaminated aerosol behavior.** Meyer, L.C.; Newton, G.J.; Cronenberg, A.W.; Loomis, G.G. EG and G Idaho, Inc., Idaho Falls, ID (United States). Apr 1994. 29p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE94015265. Source: OSTI; NTIS; INIS; GPO Dep.

An analytical and experimental study was performed on the use of lanthanide oxides (La-oxides) as surrogates for plutonium oxides (PuO_2) during simulated buried waste retrieval. This study determined how well the La-oxides move compared to PuO_2 in aerosolized soils during retrieval scenarios. As part of the analytical study, physical properties of La-oxides and PuO_2, such as molecular diameter, diffusivity, density, and molecular weight are compared. In addition, an experimental study was performed in which Idaho National Engineering Laboratory (INEL) soil, INEL soil with lanthanides, and INEL soil with plutonium were aerosolized and collected in filters. Comparison of particle size distribution parameters from this experimental study show similarity between INEL soil, INEL soil with lanthanides, and INEL soil with plutonium.

27486 (EGG-WTD–11191) **Buried Waste Integrated Demonstration stakeholder involvement model.** Kaupanger, R.M.; Kostelnik, K.M.; Milam, L.M. EG and G Idaho, Inc., Idaho Falls, ID (United States). Apr 1994. 31p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE94015384. Source: OSTI; NTIS; INIS; GPO Dep.

The Buried Waste Integrated Demonstration (BWID) is a program funded by the US Department of Energy (DOE) Office of Technology Development. BWID supports the applied research, development, demonstration, and evaluation of a suite of advanced technologies that together form a comprehensive remediation system for the effective and efficient remediation of buried waste. Stakeholder participation in the DOE Environmental Management decision-making process is critical to remediation efforts. Appropriate mechanisms for communication with the public, private sector, regulators, elected officials, and others are being aggressively pursued by BWID to permit informed participation. This document summarizes public outreach efforts during FY-93 and presents a strategy for expanded stakeholder involvement during FY-94.

27487 (EGG-WTD–11310) **Maintenance study for W-340 Waste Retrieval System.** Christensen, C.; Conner, C.C.; Sekot, J.P. EG and G Idaho, Inc., Idaho Falls, ID (United States). May 1994. 38p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE94015294. Source: OSTI; NTIS; INIS; GPO Dep.

This study was performed to identify attributes and maintainability requirements for the Tank Waste Retrieval System (TWRS). The system will be developed for Westinghouse Hanford Company in Richland, Washington, as an integrated system to perform waste removal in Tank C-106 and, thus, demonstrate technologies for tank remediation that will satisfy requirements of the Tri-Party Agreement. The study examines attributes of the TWRS, scope of maintenance operations required for the TWRS, maintenance requirements, and potential methods of performing maintenance functions. Recommendations are provided for consideration in the development of both the conceptual design and performance specification, which will be used in procuring the W-340 Waste Retrieval System.

27488 (EGG-WTD–11311) **Decontamination system study for the Tank Waste Retrieval System.** Reutzel, T.; Manhardt, J. EG and G Idaho, Inc., Idaho Falls, ID (United States). May 1994. 52p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE94015293. Source: OSTI; NTIS; INIS; GPO Dep.

This report summarizes the findings of the Idaho National Engineering Laboratory's decontamination study in support of the Tank Waste Retrieval System (TWRS) development program. Problems associated with waste stored in existing single shell tanks are discussed as well as the justification for the TWRS program. The TWRS requires a decontamination system. The subsystems of the TWRS are discussed, and a list of assumptions pertinent to the TWRS decontamination system were developed. This information was used to develop the functional and operational requirements of the TWRS decontamination system. The requirements were combined with a comprehensive review of currently available decontamination techniques to produced a set of evaluation criteria. The cleaning technologies and techniques were evaluated, and the CO_2 blasting decontamination technique was chosen as the best technology for the TWRS.

27489 (FEMP–2303) **Uranium soils integrated demonstration, 1993 status.** Nuhfer, K. Fernald Environmental Restoration Management Corp., Cincinnati, OH (United States). Fernald Environmental Management Project. [1994]. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-92OR21972. (CONF-940225–118: Waste management '94, Tucson, AZ (United States), 27 Feb - 3 mar 1994). Order Number DE94016581. Source: OSTI; NTIS; INIS; GPO Dep.

The Fernald Environmental Management Project (FEMP), operated by the Fernald Environmental Restoration Management

Corporation (FERMCO) for the DOE, was selected as the host site for the Uranium Soils Integrated Demonstration. The Uranium Soils ID was established to develop and demonstrate innovative remediation methods which address the cradle to grave elements involved in the remediation of soils contaminated with radionuclides, principally uranium. The participants in the ID are from FERMCO as well as over 15 other organizations from DOE, private industry and universities. Some of the organizations are technology providers while others are members of the technical support groups which were formed to provide technical reviews, recommendations and labor. The following six Technical Support Groups (TSGs) were formed to focus on the objective of the ID: Characterization, Excavation, Decontamination, Waste Treatment/Disposal, Regulatory, and Performance Assessment. This paper will discuss the technical achievements made to date in the program as well as the future program plans. The focus will be on the realtime analysis devices being developed and demonstrated, the approach used to characterize the physical/chemical properties of the uranium waste form in the soil and lab scale studies on methods to remove the uranium from the soil.

27490 (FEMP–2314) **Meeting the requirements for a DOE environmental restoration project. The Fernald strategy.** Vanoss, R.L. (Jacobs Engineering Group, Inc., Pasadena, CA (United States)); Risenhoover, G.M. Fernald Environmental Restoration Management Corp., Cincinnati, OH (United States). Fernald Environmental Management Project. [1994]. 12p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-92OR21972. (CONF-940632–23: Annual meeting and exhibition of the Air and Waste Management Association, Cincinnati, OH (United States), 19-24 Jun 1994). Order Number DE94015812. Source: OSTI; NTIS; INIS; GPO Dep.

Environmental Restoration (ER) of five Operable Units (OU) at Fernald Environmental Management Project (FEMP) includes compliance with the requirements of Comprehensive Environmental Response, Compensation and Liability Act (CERCLA), Resource Conservation Recovery Act (RCRA), National Environmental Policy Act (NEPA), and DOE Orders. Each regulatory driver has differing procedural requirements for documenting calculations, decisions, and actions involved in site cleanup. Integration of documentation and avoidance of duplication can save time and money. Such savings are being achieved by OU specific application of supporting studies, revised procedures, and guidance documents. Each OU is seeking appropriate opportunities to produce single documents that simultaneously fulfill the important requirements of the other regulations and DOE orders. These opportunities are evaluated at all phases of decision making, remedial design, and remedial action. Three essential processes precede environmental restoration/remedial action at a DOE site/project: 1. Completion of decision-making documents required by governing or applicable statutes. 2. Completion of important scientific and engineering analyses of remedial alternatives, and design and implementation of the remedial solution established in the CERCLA Record of Decision (ROD). 3. Preparation of DOE-mandated documentation to record engineering evaluations and cost estimates required for budgeting, decision making, and project management. Methodology and requirements for each process have developed from long, successful practice, but independently of each other. FERMCO, as new DOE contractor at Fernald and first Environmental Restoration Management Contractor (ERMC), is committed to a process of Continuous Performance Improvement (CPI). A major reevaluation of documentation and processes for support of environmental decision-making and design of cleanup activities to remediate the five OUs at the FEMP is being undertaken.

27491 (FEMP–2318) **Lessons learned during the D & D of Fernald Plant 7.** Motl, G.P.; Borgman, T.D. Fernald Environmental Restoration Management Corp., Cincinnati, OH (United States). 14 Jan 1994. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-92OR21972. (CONF-940602–13: 35. annual meeting of the American Nuclear Society, New Orleans, LA (United States), 11-16 Jun 1994). Order Number DE94015807. Source: OSTI; NTIS; INIS; GPO Dep.

This document contains information about lessons learned from the decontamination and decommissioning of the Feed Materials Production Center in Fernald Ohio. The information relates to Plant 7 which was constructed to house processes for the reduction of uranium hexafluoride to uranium tetrafluoride. Topics discussed include: washdown, lockdown, asbestos removal, and bidding for dismantlement projects.

27492 (FEMP–2322) **Demonstration of in situ-constructed horizontal soil containment barrier at Fernald.** Pettit, P.J. (Fernald Environmental Restoration Management Corp., Fernald, OH (United States)); Ridenour, D.; Walker, J.; Saugier, K. Fernald Environmental Restoration Management Corp., Cincinnati, OH (United States). Fernald Environmental Management Project. [1994]. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-92OR21972. (CONF-940225–119: Waste management '94, Tucson, AZ (United States), 27 Feb - 3 mar 1994). Order Number DE94016580. Source: OSTI; NTIS; INIS; GPO Dep.

A new design of jet grouting tool that can be guided by horizontal well casings and that operates in the horizontal plane has been used for the in situ placement of grout and construction of a prototype horizontal barrier that is free of windows. Jet grouting techniques have been advanced to permit construction of horizontal barriers underneath contaminated soil without having to excavate or disturb the waste. The paper describes progress on the Fernald Environmental Restoration Management Corporation (FERMCO) In Situ Land Containment Project which is sponsored by the US Department of Energy's (DOE) Office of Technology Development (OTD) for DOE's Fernald Environmental Management Project (FEMP). The Fernald project is to demonstrate a novel, enabling technology for the controlled underground placement of horizontal panels of grout, and the joining of adjacent panels to construct practical, extensive barriers. Construction strategy, equipment mechanics and operating details of this new method are described.

27493 (FEMP–2328) **Criticality accident alarm system at the Fernald Environmental Management Project.** Marble, R.C.; Brown, T.D.; Wooldridge, J.C. Fernald Environmental Restoration Management Corp., Cincinnati, OH (United States). Jun 1994. 30p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-92OR21972. (CONF-940602–12: 35. annual meeting of the American Nuclear Society, New Orleans, LA (United States), 11-16 Jun 1994). Order Number DE94015811. Source: OSTI; NTIS; INIS; GPO Dep.

The purpose of this paper is to give a description of the Criticality Accident Alarm System (CAAS) presently installed at the Fernald Environmental Management Project (FEMP) for monitoring areas requiring criticality controls, and some of the concerns associated with the operation of this system. The system at the FEMP is known as the Radiation Detection Alarm (RDA) System.

27494 (FEMP–2330) **Decontamination and decommissioning of Plant 7 at the Fernald Facility.** Motl, G.P.; Borgman, T. Fernald Environmental Restoration Management Corp., Cincinnati, OH (United States). Fernald Environmental Management Project. 20 Jan 1994. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-92OR21972. (CONF-940406–14: International symposium on decontamination and decommissioning, Knoxville, TN (United States), 27-29 Apr 1994). Order Number DE94015813. Source: OSTI; NTIS; INIS; GPO Dep.

The Fernald Environmental Management Project (FEMP), formerly the Feed Materials Production Center (FMPC), is a Department of Energy (DOE) site which produced high-quality uranium for military defense beginning in 1951. Production at the FEMP was halted in July 1989. Later that year, the facility was placed on the National Priorities List (NPL). The DOE is currently conducting a Remedial Investigation/Feasibility Study (RI/FS) and other response actions under the Amended Consent Agreement between the US Environmental Protection Agency (USEPA) and the DOE.

27495 (LA-SUB–94-88) **A cost-effectiveness analysis of the in situ air stripping technology at the Savannah River Integrated Demonstration site: Part 1 and Part 2.** Brill, T.C.; Brookshire, D.S.; McKee, M. New Mexico Univ., Albuquerque, NM (United States). Dept. of Economics. Jan 1994. 179p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. Order Number DE94015419. Source: OSTI; NTIS; INIS; GPO Dep.

This study reports on an evaluation of a proposed new technology for remediating existing groundwater contamination. Two tasks are undertaken in this report. The first is a conventional cost-effectiveness analysis of the new technology versus existing technologies. In this evaluation several issues are addressed such as the choice of the metric used in the cost-effectiveness analysis, the time period of the evaluation, the appropriate discount rate, and the assumptions used for extrapolation of the field data. The second task is the extension of the conventional cost-effectiveness analysis to incorporate a decision analysis framework. This extension revolves many issues raised in conducting cost-effectiveness analysis of complex technologies. It allows inclusion of physical modeling, in this case groundwater modeling, to augment the limited field data and to analyzed different implementations of the technology. This study evaluates the performance of the new technology, in situ air stripping (ISAS), as compared with a conventional technology that involves the joint use of pump and treat with soil vapor extraction (PT-SVE) using vertical wells.

27496 (NUREG/CR–6212) **Value of public health and safety actions and radiation dose avoided.** Baum, J.W. (Brookhaven National Lab., Upton, NY (United States)). Nuclear Regulatory Commission, Washington, DC (United States). Div. of Regulatory Applications; Brookhaven National Lab., Upton, NY (United States). May 1994. 44p. Sponsored by Nuclear Regulatory Commission, Washington, DC (United States). (BNL-NUREG–52413). Source: OSTI; NTIS; INIS; GPO.

The values judged best to reflect the willingness of society to pay for the avoidance or reduction of risk were deduced from studies of costs of health care, transportation safety, consumer product safety, government agency actions, wage-risk compensation, consumer behavior (market) studies, and willingness-to-pay surveys. The results ranged from $1,400,000 to $2,700,000 per life saved. Applying the mean of these values ($2,100,000) and the latest risk per unit dose coefficients used by the ICRP (1991), which take into account risks to the general public, including genetic effects and nonfatal cancers, yields a value of dose avoided of $750 to $1,500 per person-cSv for public exposures. The lower value applies if adjustments are made for years of life lost per fatality. A nominal value of $1,000 per person-cSv seems appropriate in light of the many uncertainties involved in deducing these values. These values are consistent with values recommended by several European countries for individual doses in the region of 1 mSv/y (100 mrem/y). Below this dose rate, most countries have values a factor of 7 to 10 lower, based on the assumption that society is less concerned with fatality risks below about 10^{-4}/y.

27497 Method and system for enhancing microbial motility. Hazen, T.C.; Lopez-De-Victoria, G. To Dept. of Energy. 1992. Filed date 10 Jun 1992. U.S. Patent Application 7-896,762. 19p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-76SR00001. Order Number DE94014891. Source: OSTI; NTIS; GPO Dep.

A method and system for enhancing the motility of microorganisms by placing an effective amount of chlorinated hydrocarbons, preferably chlorinated alkenes, and most preferably trichloroethylene in spaced relation to the microbes so that the surprisingly strong, monomodal, chemotactic response of the chlorinated hydrocarbon on subsurface microbes can draw the microbes away from or towards and into a substance, as desired. In remediation of groundwater pollution, for example, TCE can be injected into the plume to increase the population of microbes at the plume whereby the plume can be more quickly degraded. A TCE-degrading microbe, such as Welchia alkenophilia, can be used to degrade the TCE following the degradation of the original pollutant.

27498 Bioremediation of contaminated groundwater. Hazen, T.C.; Fliermans, C.B. To Dept. of Energy. 1992. Filed date 27 Aug 1992. U.S. Patent Application 7-935,950. 24p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035. Order Number DE94016105. Source: OSTI; NTIS; INIS; GPO Dep.

The present invention relates to a method for in situ bioremediation of contaminated soil and groundwater. In particular, the invention relates to remediation of contaminated soil and groundwater by the injection of nutrients to stimulate growth of pollutant-degrading microorganisms. The United States Government has rights in this invention pursuant to Contract No. DE-AC09-89SR18035 between the US Department of Energy and Westinghouse Savannah River Company.

27499 (PNL–9412) **Experimental plan and construction guidance for Hanford Protective Barrier Test at Hill AFB, Utah.** Kirkham, R.R.; Gee, G.W. Pacific Northwest Lab., Richland, WA (United States). Apr 1994. 28p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE94011138. Source: OSTI; NTIS; GPO Dep.

Permanent isolation surface barriers are needed to fully isolate buried waste materials for long periods of time from the general environment. Multi-layer surface barriers that use natural earthen materials overlying bio-intrusion layers of rock and/or asphalt are expected to reduce infiltration or deep percolation to less than 0.5 mm (0.02 in.) of water. The layering also reduces root penetration, preventing uptake and translocation of hazardous materials to the surface vegetation. The opportunity exists to test the Hanford Barrier in a wetter, colder climate at an existing lysimeter facility located at Hill Air Force Base near Salt Lake, Utah. The use of an existing lysimeter facility simplifies the construction effort and allows comparison of the Hanford Protective Barrier with an existing US Environmental Protection Agency-Resource Conservation and Recovery Act clay cap already undergoing tests at the lysimeter site. This document presents the experimental plan for testing the Hanford Protective Barrier in a wetter, colder climate.

27500 (PNL–9421) **Streamlined approach for environmental restoration (SAFER): Development, implementation, and lessons learned.** Smyth, J.D. (CH2M Hill Richland, WA (United States)); Amaya, J.P. Pacific Northwest Lab., Richland, WA (United States). May 1994. 87p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE94013365. Source: OSTI; NTIS; GPO Dep.

This report reviews the US Department of Energy's (DOE's) Streamlined Approach for Environmental Restoration (SAFER) effort during FY 1992, FY 1993, and the first quarter of FY 1994. The report comprises three sections: Introduction, Activities Summary, and Lessons Learned and Related Activities. This section provides context for the report by briefly reviewing the development of SAFER and its operational assumptions. Section 2 describes SAFER workshops and site-specific SAFER implementation support. Additionally, Section 2 provides an update on the status of sites that initially received support from either Observational Approach or SAFER teams and subsequently implemented either of these two related approaches to site restoration streamlining. Section 3 describes lessons learned and upcoming SAFER activities.

27501 (PNL–9961) **Modeling and analysis of ORNL horizontal storage tank mobilization and mixing.** Mahoney, L.A.; Terrones, G.; Eyler, L.L. Pacific Northwest Lab., Richland, WA (United States). Jun 1994. 70p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE94015881. Source: OSTI; NTIS; INIS; GPO Dep.

The retrieval and treatment of radioactive sludges that are stored in tanks constitute a prevalent problem at several US Department of Energy sites. The tanks typically contain a settled sludge layer with non-Newtonian rheological characteristics covered by a layer of supernatant. The first step in retrieval is the mobilization and mixing of the supernatant and sludge in the storage tanks. Submerged jets have been proposed to achieve sludge mobilization in tanks, including the 189 m^3 (50,000 gallon) Melton Valley Storage tanks (MVST) at Oak Ridge National Laboratory (ORNL) and the planned 378 m^3 (100,000 gallon) tanks being designed as part of the MVST Capacity Increase Project (MVST-CIP). This report focuses on the modeling of mixing and mobilization in horizontal cylindrical tanks like those of the MVST design using submerged, recirculating liquid jets. The computer modeling of the mobilization and mixing processes uses the TEMPEST computational fluid dynamics program (Trend and Eyler 1992). The goals of the simulations are to determine under what conditions sludge mobilization using submerged liquid jets is feasible in tanks of this configuration, and to estimate mixing times required to approach homogeneity of the contents.

27502 (PNL-SA-24419) **Pacific Northwest Laboratory environmental technologies available for deployment.** Slate, S.C. Pacific Northwest Lab., Richland, WA (United States). Jul 1994. 38p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE94015205. Source: OSTI; NTIS; INIS; GPO Dep.

The Department of Energy created the Office of Environmental Management (EM) to conduct a 30-year plus, multi-billion dollar program to manage the wastes and cleanup the legacy from over fifty years of nuclear material production. Across the DOE System there are thousands of sites containing millions of metric tons of buried wastes and contaminated soils and groundwater. Additionally, there are nearly 400,000 m^3 of highly radioactive wastes in underground storage tanks, over 1,400 different mixed-waste streams, and thousands of contaminated surplus facilities, some exceeding 200,000 m^2 in size. Costs to remediate all these problems have been estimated to be as much as several hundred billion dollars. The tremendous technical challenges with some of the problems and the high costs of using existing technologies has led the Department to create the Office of Technology Development (TD) to lead an aggressive, integrated national program to develop and deploy the needed advanced, cost-effective technologies. This program is developing technologies for all major cleanup steps: assessment, characterization, retrieval, treatment, final stabilization, and disposal. Work is focused on the Department's five major problem areas: High-Level Waste Tank Remediation; Contaminant Plume Containment and Remediation; Mixed Waste Characterization, Treatment, and Disposal; Contaminated Soils and Buried Wastes Facility Transitioning, Decommissioning, and Final Disposal.

27503 (RFP-4810) **Comparative risk analysis for the Rocky Flats Plant integrated project planning.** Jones, M.E.; Shain, D.I. EG and G Rocky Flats, Inc., Golden, CO (United States). Rocky Flats Plant. [1994]. 12p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC34-90DP62349. (CONF-940650-3: 19. annual conference and exposition of the National Association of Environmental Professionals (NAEP): global strategies for environmental issues, New Orleans, LA (United States), 12-15 Jun 1994). Order Number DE94011163. Source: OSTI; NTIS; INIS; GPO Dep.

The Rocky Flats Plant is developing, with active stakeholder a comprehensive planning strategy that will support transition of the Rocky Flats Plant from a nuclear weapons production facility to site cleanup and final disposition. Final disposition of the Rocky Flats Plant materials and contaminants requires consideration of the interrelated nature of sitewide problems, such as material movement and disposition, facility and land use endstates, costs relative risks to workers and the public, and waste disposition. Comparative Risk Analysis employs both incremental risk and cumulative risk evaluations to compare risks from postulated options or endstates. These postulated options or endstates can be various remedial alternatives, or future endstate uses of federal agency land. Currently, there does not exist any approved methodology that aggregates various incremental risk estimates. Comparative Risk Analysis has been developed to aggregate various incremental risk estimates to develop a site cumulative risk estimate. This paper discusses development of the Comparative Risk Analysis methodology, stakeholder participation and lessons learned from these challenges.

27504 (RFP-4848) **Establishing quantities of hazardous material below which USQD/ASA process is not initiated.** White, B.W. EG and G Rocky Flats, Inc., Golden, CO (United States). Rocky Flats Plant. [1994]. 3p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC34-90DP62349. (CONF-9406161-1: Safety analysis working group workshop, Albuquerque, NM (United States), 8-10 Jun 1994). Order Number DE94011229. Source: OSTI; NTIS; INIS; GPO Dep.

Short communication. HAZARDOUS MATERIALS/regulations; REGULATIONS; HEALTH HAZARDS; EMERGENCY PLANS

27505 (SAND-94-0668C) **Zeroing in on requirements: Sandia National Laboratories' approach to meaningful program improvement.** Friend, J.C. (MACTEC, Albuquerque, NM (United States)); Richards, R.R.; Jaramillo, C.P. Sandia National Labs., Albuquerque, NM (United States). [1994]. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. (CONF-940985-4: American Society for Quality Control Energy and Environmental Quality Division conference, Tucson, AZ (United States), 18-21 Sep 1994). Order Number DE94015738. Source: OSTI; NTIS; GPO Dep.

The necessity to evaluate our participant Quality Assurance (QA) Program for the Yucca Mountain Site Characterization Project (YMP) against the Office of Civilian Radioactive Waste Management (OCRWM) Quality Assurance Requirements and Description (QARD) issued December 1992, presented an opportunity to improve the QA Program. For some time, the SNL YMP technical staff had complained that the QA requirements imposed on their work were cumbersome and inhibited their ability to perform investigations using scientific methods. There was some truth to this, since SNL had over the years developed some procedures with many detailed controls that were far beyond what was required by project QA requirements. This had occurred either as a result of responding to numerous audit findings with a "make the auditor happy" attitude or with an attempt to cover every contingency. Procedures affecting scientific work were authored by the technical staff in an effort to provide them with ownership of the process; unfortunately, there were problems. Procedures were inconsistent because of the varied writing styles and differing perceptions of the degree of QA controls required to implement the program. It was extremely difficult to get all of the technical staff to accept the QA program as it was intended. These issues were endemic to the program and resulted in the QARD, the actual requirements, being written by a team of QA professionals. Once new QARD requirements were issued, an opportunity to evaluate the QA Program and to revise it not only to meet the QARD, but also to make it more plausible and meaningful to the technical staff, was presented. The discussion that follows will describe how the program was changed, will present both the positive and negative experiences observed by SNL personnel during the QARD transition, and will provide some recommendations.

27506 (SAND-94-0764C) **The Assessment of Future Human Actions at Radioactive Waste Disposal Sites: An international perspective.** Anderson, D.R. (Sandia National Labs., Albuquerque, NM (United States)); Galson, D.A.; Patera, E.S. Sandia National Labs., Albuquerque, NM (United States). [1994]. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. (CONF-940553-19: International high-level radioactive waste management conference, Las Vegas, NV (United States), 22-26 May 1994). Order Number DE94008923. Source: OSTI; NTIS; INIS; GPO Dep.

For some deep geological disposal systems, the level of confinement provided by the natural and engineered barriers is considered to be so high that the greatest long-term risks associated with waste disposal may arise from the possibility of future human actions breaching the natural and/or engineered barrier systems. Following a Workshop in 1989, the OECD Nuclear Energy Agency established a Working Group on Assessment of Future Human Actions (FHA) a Radioactive Waste Disposal Sites. This Group met four times in the period 1991–1993, and has extensively reviewed approaches to and experience of incorporating the effects of FHA into long-term performance assessments (PAs). The Working Group's report reviews the main issues concerning the treatment of FHA, presents a general framework for the quantitative, consideration of FHA in radioactive waste disposal programmes, and discusses means in reduce the risks associated with FHA. The Working Group concluded that FHA must be considered in PAs, although FHA where the actors were cognizant of the risks could be ignored. Credit can be taken for no more than several hundred years of active site control; additional efforts should therefore be taken to reduce the risks associated with FHA. International agreement on principles for the construction of FHA scenarios would build confidence, as would further discussion concerning regulatory policies for judging risks associated with FHA.

27507 (WHC-EP-0407-Rev.2) **Action plan for response to abnormal conditions in Hanford Site radioactive waste tanks containing ferrocyanide: Revision 2.** Fowler, K.D. Westinghouse Hanford Co., Richland, WA (United States). Jun 1994. 28p. Sponsored by USDOE, Washington, DC (United States). DOE Contract

AC06-87RL10930. Order Number DE94016473. Source: OSTI; NTIS; INIS; GPO Dep.

This action plan describes the administrative controls, monitoring frequencies, monitoring criteria, and reporting requirements that have been implemented for the Ferrocyanide Watch List tanks. In addition, corrective actions have been outlined where a response to an abnormal condition in a Ferrocyanide Watch List tank is warranted. Such responses may be due to changes in tank temperatures or pressures; flammable or toxic vapor concentrations, or airborne radiation levels. Additionally, this plan identifies source documents that detail the following: the criteria and specification limits required for ensuring that Ferrocyanide Watch List tanks are maintained in a SAFE or CONDITIONALLY SAFE state; response actions for prevention or mitigation of the consequences of an abnormal condition; and organizational responsibilities for ensuring that ferrocyanide tanks are maintained in a SAFE or CONDITIONALLY SAFE state and for responding to abnormal conditions.

27508 (WHC-EP-0473-Rev.1) **Action plan for response to excessive temperature in high heat source waste tank 241-C-106 at the Hanford site: Revision 1.** DeFigh-Price, C.; Wang, O.S. Westinghouse Hanford Co., Richland, WA (United States). Jun 1993. 36p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE94016476. Source: OSTI; NTIS; INIS; GPO Dep.

This action plan identifies the responses that shall be implemented if anomalies in temperature measurements, or conditions that could lead to temperature anomalies (such as a leaking tank), are observed in tank 241-C-106 of the Hanford site C Tank Farm. This plan also summarizes (1) the criteria and specification limits required for ensuring that tank 241-C-106 is maintained in a safe condition; (2) the responsible organizations for tank 241-C-106; and (3) response actions to prevent or mitigate safety concerns. The main safety concern unique to tank 241-C-106 is the temperature rise due to heat generation by the waste content.

27509 (WHC-EP-0513) **Threatened and endangered wildlife species of the Hanford Site related to CERCLA characterization activities.** Fitzner, R.E. (Pacific Northwest Lab., Richland, WA (United States)); Weiss, S.G.; Stegen, J.A. Westinghouse Hanford Co., Richland, WA (United States). Jun 1994. 48p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE94015336. Source: OSTI; NTIS; GPO Dep.

The US Department of Energy's (DOE) Hanford Site has been placed on the National Priorities List, which requires that it be remediated under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) or Superfund. Potentially contaminated areas of the Hanford Site were grouped into operable units, and detailed characterization and investigation plans were formulated. The DOE Richland Operations Office requested Westinghouse Hanford Company (WHC) to conduct a biological assessment of the potential impact of these characterization activities on the threatened, endangered, and sensitive wildlife species of the Hanford Site. Additional direction for WHC compliances with wildlife protection can be found in the Environmental Compliance Manual. This document is intended to meet these requirements, in part, for the CERCLA characterization activities, as well as for other work comparable in scope. This report documents the biological assessment and describes the pertinent components of the Hanford Site as well as the planned characterization activities. Also provided are accounts of endangered, threatened, and federal candidate wildlife species on the Hanford Site and information as to how human disturbances can affect these species. Potential effects of the characterization activities are described with recommendations for mitigation measures.

27510 (WHC-EP-0722-Add.2) **Systems engineering functions and requirements for the Hanford cleanup mission: First issue, Addendum 2.** Holmes, J.J. Westinghouse Hanford Co., Richland, WA (United States). Jan 1994. 324p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE94011337. Source: OSTI; NTIS; GPO Dep.

This addendum provides the technical detail of a systems engineering functional analysis for the Hanford cleanup mission. Details of the mission analysis including mission statement, scope, problem statement, initial state definition, and final state definition are provided in the parent document. The functional analysis consists of Input Computer Automated Manufacturing Definition (IDEFO) diagrams an definitions, which will be understood by systems engineers, but which may be difficult for others to comprehend. For a more complete explanation of this work, refer to the parent document. The analysis covers the total Hanford cleanup mission including the decomposition levels at which the various Hanford programs or integrated activities are encountered.

27511 (WHC-EP-0722-Add.3-Draft) **Systems engineering functions and requirements for the Hanford cleanup mission: First issue: Addendum 3, Draft.** Holmes, J.J. (Westinghouse Hanford Co., Richland, WA (United States)); Bailey, K.B.; Collings, J.L.; Hubbard, A.B.; Niepke, T.M. Westinghouse Hanford Co., Richland, WA (United States). May 1994. 119p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE94015662. Source: OSTI; NTIS; INIS; GPO Dep.

This addendum provides additional information, in the form of Functional Flow Block Diagrams (FFBD), concerning the system engineering functional analysis for the Hanford cleanup mission. Details of the mission analysis including mission statement, scope, problem statement, initial state definition, and final state definition are provided in the parent document. The results of the functional analysis as depicted in Integrated Definition language notation (IDEFO) diagrams are provided in Addendum 2 to the parent document. The FFBDs provided herein cover the total Hanford cleanup mission and depict the decomposition of functions to a reasonable level for understanding (generally level 3 or 4). Functional definitions are contained in Section 3.0 of Addendum 2 to the parent document. Specific programs such as the Tank Waste Remediation System and Environmental Restoration, whose IDEFO diagrams were presented as part of their specific baseline documentation and not included in Addendum 2, have their FFBDs included in this addendum. The information contained in this addendum will remain tied to the overall Hanford cleanup mission through the top-level ("Capstone") functional analysis so that a complete, top-to-bottom functional documentation set always exists for all mission activities. This linkage is accomplished through the use of the Requirements Driven Design (RDD-100®) design tool. Through the use of RDD-100®, this addendum supports and is traceable to the information presented in Addendum 2 to the parent document.

27512 (WHC-EP-0743) **Decision analysis for continuous cover gas monitoring of Ferrocyanide Watch List tanks.** Fowler, K.D. (Westinghouse Hanford Co., Richland, WA (United States)); Graves, R.D. Westinghouse Hanford Co., Richland, WA (United States). Jul 1994. 33p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE94016459. Source: OSTI; NTIS; INIS; GPO Dep.

This document pertains to underground waste storage tanks at the Hanford Site that have been identified to potentially contain a significant amount of ferrocyanide compounds. This document evaluates the need for continuously monitoring the headspace vapors in Ferrocyanide Watch List tanks to detect flammable gases or gases that could indicate the occurrence of a propagating ferrocyanide-nitrate/nitrite reaction. The results of modeling studies and gas monitoring, and sludge sample analyses of actual ferrocyanide tank wastes have indicated no need to continuously monitor the vapor spaces in ferrocyanide tanks. This conclusion is based in part on the following factors: (1) a study performance on waste aging suggests that the ferrocyanide has degraded in the tanks during the more than 35 years of storage; therefore, the ferrocyanide is not present in concentrations that could support an exothermic reaction, also, the moisture present in the waste is sufficient to preclude a self-sustaining (propagating) ferrocyanide-nitrate reaction; (2) evaluation of core sample results from Tank 241-C-109 and Tank 241-C-112 support laboratory studies showing that ferrocyanide has degraded and the fuel concentration in the tanks is considerably lower than postulated by flowsheet simulants; (3) no gases have been identified that would indicate the occurrence of a ferrocyanide nitrate/nitrite reaction; additionally, a self-sustaining ferrocyanide nitrate/nitrite reaction is not possible

under current and future planned storage conditions. After reviewing the available information, it is evident that there would be little safety benefit from continuous in-tank vapor monitoring, and the time and commitment of operations schedule and equipment funds are not justified in the face of competing needs.

27513 (WHC-EP–0772) **Characterization of the corrosion behavior of the carbon steel liner in Hanford Site single-shell tanks.** Anantatmula, R.P. (Westinghouse Hanford Co., Richland, WA (United States)); Schwenk, E.B.; Danielson, M.J. Westinghouse Hanford Co., Richland, WA (United States). Jun 1994. 74p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE94016475. Source: OSTI; NTIS; INIS; GPO Dep.

Six safety initiatives have been identified for accelerating the resolution of waste tank safety issues and closure of unreviewed safety questions. Safety Initiative 5 is to reduce safety and environmental risk from tank leaks. Item d of Safety Initiative 5 is to complete corrosion studies of single-shell tanks to determine failure mechanisms and corrosion control options to minimize further degradation by June 1994. This report has been prepared to fulfill Safety Initiative 5, Item d. The corrosion mechanisms that apply to Hanford Site single-shell tanks are stress corrosion cracking, pitting/crevice corrosion, uniform corrosion, hydrogen embrittlement, and microbiologically influenced corrosion. The corrosion data relevant to the single-shell tanks dates back three decades, when results were obtained from in-situ corrosion coupons in a few single-shell tanks. Since that time there have been intertank transfers, evaporation, and chemical alterations of the waste. These activities have changed the character and the present composition of the waste is not well characterized. All conclusions and recommendations are made in the absence of relevant laboratory experimental data and tank inspection data. The report attempts to identify the failure mechanisms by a literature survey of carbon steel data in environments similar to the single-shell tank wastes, and by a review of the work performed at the Savannah River Site where similar wastes are stored in similar carbon steel tanks. Based on these surveys, and in the absence of data specific to Hanford single-shell tanks, it may be concluded that the single-shell tanks identified as leakers failed primarily by stress corrosion cracking due to the presence of high nitrate/low hydroxide wastes and residual stresses. In addition, some failures may be attributed to pitting under crevices in low hydroxide locations.

27514 (WHC-SA–2388) **Establishing a predictive maintenance program at the Hanford Site.** Winslow, R.W. Westinghouse Hanford Co., Richland, WA (United States). May 1994. 41p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-9405122–2: DOE predictive maintenance technology symposium, Atlanta, GA (United States), 16-18 May 1994). Order Number DE94011334. Source: OSTI; NTIS; INIS; GPO Dep.

This document contains information about a new Predictive Maintenance Program being developed and implemented at the Hanford Reservation. Details of the document include: background on persons developing the program, history of predictive maintenance, implementation of new program, engineering task analysis, network development and new software, issues to be resolved, benefits expected, and appendix gives information about the symposium from which this paper is based.

27515 (WHC-SD-EN-PMP–008) **Project management plan, N Springs expedited response action.** Jackson, G.J. Westinghouse Hanford Co., Richland, WA (United States). 28 Jun 1994. 24p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE94015331. Source: OSTI; NTIS; INIS; GPO Dep.

In accordance with the past-practice strategy, the US Department of Energy (DOE) is conducting an expedited response action (ERA) at the N Springs, located in the Hanford 100 N Area. This Project Management Plan (PMP) addresses the design and construction of a sheet pile barrier and the design, construction, and operation of an ion-exchanged pump and treat system at N Springs. There were three objectives set for the N Springs ERA, which are outlined in Item 6 in the Senior Executive Agreement Committee Agreement on the Resolution of Milestone M-14-00 Change Request Dispute. The first N Springs ERA objective is to eliminate or substantially reduce the flux of strontium-90 to the N Springs, and ultimately to the Columbia River via groundwater migration. A sheet pile barrier will be installed in the path of groundwater flow, forcing strontium-90 contaminated groundwater to flow around it in order to reach the river, substantially decreasing groundwater flow velocity. Since the strontium transport velocity is approximately 2 orders of magnitude less than that of the groundwater in the vicinity, the flux of strontium-90 to the river will be reduced. The second N Springs ERA objective is to evaluate commercially available treatment options for strontium-90 contaminated groundwater. The third N Spring ERA objective is to provide data necessary to set appropriate strontium-90 contaminated groundwater cleanup standards.

27516 (WHC-SD-EN-RA–005) **Qualitative risk assessment for 100-DR-1 source operable unit.** Naiknimbalkar, N.M. Westinghouse Hanford Co., Richland, WA (United States). 14 Jul 1994. 374p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE94016234. Source: OSTI; NTIS; INIS; GPO Dep.

The Washington State Department of Ecology (Ecology), the US Environmental Protection Agency (EPA), and the US Department of Energy (DOE), signatories to the Hanford Federal Facility Agreement and Consent Order have developed the Hanford site Past-Practice Strategy to emphasize initiating and completing waste site cleanups with a bias for action. This strategy relies, in part, upon the use of a qualitative risk assessment (QRA) to assist in decision-making. The QRA is performed using the Hanford Site Baseline Risk Assessment Methodology (HSBRAM) as guidance (DOE-RL 1993a). The results will be used, along with other considerations, to make a recommendation for or against an interim remedial measure (IRM) at each high-priority waste site. The objective of conducting IRMs at Hanford, is to achieve cleanup and reduce risk in the shortest time possible and in a cost effective manner.

27517 (WHC-SD-EN-RA–010) **Qualitative risk assessment for the 100-KR-4 groundwater operable unit.** Biggerstaff, R.L. Westinghouse Hanford Co., Richland, WA (United States). 30 Jun 1994. 81p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE94015671. Source: OSTI; NTIS; INIS; GPO Dep.

This report provides the qualitative risk assessment (QRA) for the 100-KR-4 groundwater operable unit at the US Department of Energy's (DOE) Hanford Site in southeastern Washington State. The extent of the groundwater beneath the 100 K Area is defined in the Remedial Investigation/Feasibility Study Work Plan for the 100-KR-4 Operable Unit (DOE-RL 1992a). The QRA is an evaluation or risk using a limited amount of data and a predefined set of human and environmental exposure scenarios and is not intended to replace or be a substitute for a baseline risk assessment.

27518 (WHC-SD-EN-TI–210) **Geophysical investigation of the "Thimble," 100-H Area.** Bergstrom, K.A. Westinghouse Hanford Co., Richland, WA (United States). 8 Jul 1994. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE94015728. Source: OSTI; NTIS; INIS; GPO Dep.

This report summarizes the results of the geophysical investigations conducted as part of the characterization of the buried "Thimble" site. The site is located just south of the 116-H-2 Crib and is in the 100-HR-2 Operable Unit. Available documentation has it located between, and at the convergence of, two railroad spurs that run north-south. A concrete monument is believed to mark the site. The burial ground is suspected of containing a vertical safety rod thimble that is reportedly 40 ft long. Ground-penetrating radar (GPR) and electromagnetic induction (EMI) were the two techniques used in the investigation. The methods were selected because they are non-intrusive, relatively fast, economical, and have been used successfully in other similar investigations on the Hanford Site. The objective of the investigation was to locate the buried thimble.

27519 (WHC-SD-EN-TI–242) **2727-S Nonradioactive Dangerous Waste Storage Facility clean closure evaluation report.** Luke, S.N. Westinghouse Hanford Co., Richland, WA (United

States). 14 Jul 1994. 133p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE94015754. Source: OSTI; NTIS; INIS; GPO Dep.

This report presents the analytical results of 2727-S NRDWS facility closure verification soil sampling and compares these results to clean closure criteria. The results of this comparison will determine if clean closure of the unit is regulatorily achievable. This report also serves to notify regulators that concentrations of some analytes at the site exceed sitewide background threshold levels (DOE-RL 1993b) and/or the limits of quantitation (LOQ). This report also presents a Model Toxics Control Act Cleanup (MTCA) (WAC 173-340) regulation health-based closure standard under which the unit can clean close in lieu of closure to background levels or LOQ in accordance with WAC 173-303-610. The health-based clean closure standard will be closure to MTCA Method B residential cleanup levels. This report reconciles all analyte concentrations reported above background or LOQ to this health-based cleanup standard. Regulator acceptance of the findings presented in this report will qualify the TSD unit for clean closure in accordance with WAC 173-303-610 without further TSD unit soil sampling, or soil removal and/or decontamination. Nondetected analytes require no further evaluation.

27520 (WHC-SD-EN-TI-245) **Passive vapor extraction feasibility study.** Rohay, V.J. Westinghouse Hanford Co., Richland, WA (United States). 30 Jun 1994. 74p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE94015672. Source: OSTI; NTIS; INIS; GPO Dep.

Demonstration of a passive vapor extraction remediation system is planned for sites in the 200 West Area used in the past for the disposal of waste liquids containing carbon tetrachloride. The passive vapor extraction units will consist of a 4-in.-diameter pipe, a check valve, a canister filled with granular activated carbon, and a wind turbine. The check valve will prevent inflow of air that otherwise would dilute the soil gas and make its subsequent extraction less efficient. The granular activated carbon is used to adsorb the carbon tetrachloride from the air. The wind turbine enhances extraction rates on windy days. Passive vapor extraction units will be designed and operated to meet all applicable or relevant and appropriate requirements. Based on a cost analysis, passive vapor extraction was found to be a cost-effective method for remediation of soils containing lower concentrations of volatile contaminants. Passive vapor extraction used on wells that average 10-$stdft^3$/min air flow rates was found to be more cost effective than active vapor extraction for concentrations below 500 parts per million by volume (ppm) of carbon tetrachloride. For wells that average 5-$stdft^3$/min air flow rates, passive vapor extraction is more cost effective below 100 ppm.

27521 (WHC-SD-EN-TI-264) **Remedial design/remedial action strategy report.** Dieffenbacher, R.G. Westinghouse Hanford Co., Richland, WA (United States). 30 Jun 1994. 84p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE94015636. Source: OSTI; NTIS; GPO Dep.

This draft Regulatory Compliance Strategy (RCS) report will aid the ER program in developing and implementing Remedial Design/Remedial Action (RD/RA) projects. The intent of the RCS is to provide guidance for the implementation of project management requirements and to allow the implementation of a flexible, graded approach to design requirements depending on the complexity, magnitude, schedule, risk, and cost for any project. The RCS provides a functional management-level guidance document for the identification, classification, and implementation of the managerial and regulatory aspects of an ER project. The RCS has been written from the perspective of the ER Design Manager and provides guidance for the overall management of design processes and elements. The RCS does not address the project engineering or specification level of detail. Topics such as project initiation, funding, or construction are presented only in the context in which these items are important as sources of information or necessary process elements that relate to the design project phases.

27522 (WHC-SD-EN-TI-279) **Summary of remedial investigations at the 307 retention basins and 307 trenches (316-3), 300-FF-2 Operable Unit.** Hulstrom, L.C. Westinghouse Hanford Co., Richland, WA (United States). 30 Jun 1994. 160p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE94015649. Source: OSTI; NTIS; INIS; GPO Dep.

Remedial investigations at the 307 retention basins and 307 trenches (316-3) in the 300 Area of the Hanford Site were conducted as part of the 300-FF-1 operable unit Phase 1 remedial investigation (RI) in accordance with the approved RI work plan. During the RI, the southwestern boundary of the 300-FF-1 operable unit was modified by all signatories to the Hanford Federal Facility Agreement and Consent Order, which shifted the 307 retention basins and 307 trenches to the 300-FF-3 operable unit. As a consequence, the RI results from these waste management units were not included in the Phase 1 Remedial Investigation Report for the 300-FF-1 Operable Unit. As a results of recent Hanford Federal Facility Agreement and Consent Order negotiations, the 300-FF-2 operable unit now consists of the remaining 300 Area operable units within the 300 Area National Priorities List (NPL), which includes the former 300-FF-3 operable unit. Therefore, this document summarizes the RI results from the 307 retention basins and 307 trenches in the 300-FF-2 operable unit. Analysis and evaluation of these results well be included in the 300-FF-2 RI report.

27523 (WHC-SD-EN-TP-049) **118-B-1 excavation treatability test procedures.** Frain, J.M. Westinghouse Hanford Co., Richland, WA (United States). [1994]. 38p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE94015752. Source: OSTI; NTIS; INIS; GPO Dep.

This treatability study has two purposes: to support development of the approach to be used for burial ground remediation, and to provide specific engineering information for the design of burial grounds receiving waste generated from the 100 Area removal actions. Data generated from this test will also provide performance and cost information necessary for detailed analysis of alternatives for burial ground remediation. Further details on the test requirements, milestones and data quality objectives are described in detail in the 118-B-1 Excavation Treatability Test Plan (DOE/RL-94-43). These working procedures are intended for use by field personnel to implement the requirements of the milestone. A copy of the detailed Test Plan will be kept on file at the on-site field support trailer, and will be available for review by field personnel.

27524 (WHC-SD-NR-TI-053) **Fire loading calculations for 300 Area N Reactor Fuel Fabrication and Storage Facility.** Myott, C.F. Westinghouse Hanford Co., Richland, WA (United States). 24 Jan 1994. 101p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE94015644. Source: OSTI; NTIS; GPO Dep.

Fire loading analyses were provided for the N Reactor Fuel Supply Buildings 3712, 3716, 303A, 303B, 303E, 303G, and 303K. Fire loading calculations, maximum temperatures, and fire durations were provided to support the safety analyses documentation. The "combustibles" for this document include: wood, cardboard, cloth, and plastic, and does not include the uranium and fuel assembly loading. The information in this document will also be used to support the fire hazard analysis for the same buildings, therefore, it is assumed that sprinkler systems do not work, or the maximum possible fire loss is assumed.

27525 (WSRC-MS-94-0107) **Decontamination and decommissioning experience at the Savannah River Site.** Monson, R.W. Westinghouse Savannah River Co., Aiken, SC (United States). [1994]. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035. (CONF-940748-23: Institute of Nuclear Materials Management annual meeting, Naples, FL (United States), 17-20 Jul 1994). Order Number DE94015589. Source: OSTI; NTIS; INIS; GPO Dep.

A continuing concern within the DOE complex is how to address the retirement contains special of a facility which nuclear material (SNM). When the life expectancy of a facility has been reached, decisions must be made pertaining to (1) rial from the facility, removing the mate (2) accounting for the material and (3) final disposition of the material. This paper will discuss such a decontamination and decommissioning (D&D) process which we are presently dealing with at the Savannah River Site. The process

must follow DOE Order 5633.3A as well as internal Company procedures regarding MC&A. In some D&D cases the material can be exempt from the DOE Order when all of the following criteria are met: (1) the material has been declared waste, (2) the material has been written off the MC&A books, and (3) the material is under the control of a waste management organization.

27526 (WSRC-RP–94-607) **A/M Area Groundwater Corrective Action Southern Sector Remediation Technology Alternatives Evaluation.** Looney, B.B.; Phifer, M.A. Westinghouse Savannah River Co., Aiken, SC (United States). 30 Jun 1994. 45p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035. Order Number DE94016536. Source: OSTI; NTIS; INIS; GPO Dep.

Several technologies for clean up of solvents such as trichloroethylene, from groundwater were examined to determine the most reasonable strategy for the southern Sector in A/M Area of Savannah River Site. The most promising options identified were: pump and treat technology, airlift recirculation technology, and bioremediation technology. These options range from baseline/traditional methods to more innovative technologies. The traditional methods would be straightforward to implement, while the innovative methods have the potential to improve efficiency and reduce long term costs.

27527 (WSRC-TR–93-872-Rev.1) **Canyon transfer neutron absorber to fissile material ratio analysis: Revision 1.** Clemmons, J.S. Westinghouse Savannah River Co., Aiken, SC (United States). 4 Mar 1994. 83p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035. Order Number DE94015833. Source: OSTI; NTIS; INIS; GPO Dep.

Waste tank fissile material and non-fissile material estimates are used to evaluate criticality safety for the existing sludge inventory and batches of sludge sent to Extended Sludge Processing (ESP). This report documents the weight ratios of several non-fissile waste constituents to fissile waste constituents from canyon reprocessing waste streams. Weight ratios of Fe, Mn, Al, Mi, and U-238 to fissile material are calculated from monthly loss estimates from the F and H Canyon Low Heat Waste (LHW) and High Heat Waste (HHW) streams. The monthly weight ratios for Fe, Mn and U-238 are then compared to calculated minimum safe weight ratios. Documented minimum safe weight ratios for Al and Ni to fissile material are currently not available. Total mass data for the subject sludge constituents is provided along with scatter plots of the monthly weight ratios for each waste stream.

27528 (WSRC-TR–94-0160) **Lessons learned bulletin: Number 2.** Westinghouse Savannah River Co., Aiken, SC (United States). May 1994. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035. Order Number DE94011169. Source: OSTI; NTIS; INIS; GPO Dep.

During the past four years, the Department of Energy – Savannah River Operations Office and the Westinghouse Savannah River Company (WSRC) Environmental Restoration (ER) Program completed various activities ranging from waste site investigations to closure and post closure projects. Critiques for lessons learned regarding project activities are performed at the completion of each project milestone, and this critique interval allows for frequent recognition of lessons learned. In addition to project related lessons learned, ER also performs lessons learned critiques. T'he Savannah River Site (SRS) also obtains lessons learned information from general industry, commercial nuclear industry, naval nuclear programs, and other DOE sites within the complex. Procedures are approved to administer the lessons learned program, and a database is available to catalog applicable lessons learned regarding environmental remediation, restoration, and administrative activities. ER will continue to use this database as a source of information available to SRS personnel.

27529 (WSRC-TR–94-0179) **Test plan for the soils facility demonstration: A petroleum contaminated soil bioremediation facility.** Lombard, K.H. Westinghouse Savannah River Co., Aiken, SC (United States). [1994]. 18p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035. Order Number DE94016966. Source: OSTI; NTIS; INIS; GPO Dep.

The objectives of this test plan are to show the value added by using bioremediation as an effective and environmentally sound method to remediate petroleum contaminated soils (PCS) by: demonstrating bioremediation as a permanent method for remediating soils contaminated with petroleum products; establishing the best operating conditions for maximizing bioremediation and minimizing volatilization for SRS PCS during different seasons; determining the minimum set of analyses and sampling frequency to allow efficient and cost-effective operation; determining best use of existing site equipment and personnel to optimize facility operations and conserve SRS resources; and as an ancillary objective, demonstrating and optimizing new and innovative analytical techniques that will lower cost, decrease time, and decrease secondary waste streams for required PCS assays.

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Refer also to citation(s) 27374, 27432, 27747, 27973, 28327, 28960

27530 (ANL/RA/CP–83425) **The Mass Tracking System for the Integral Fast Reactor fuel cycle.** Adams, C.H. (Argonne National Lab., IL (United States)); Beitel, J.C.; Birgersson, G.; Bucher, R.G.; Carrico, C.B.; Daly, T.A.; Keyes, R.W. Argonne National Lab., IL (United States). [1994]. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-940748–7: Institute of Nuclear Materials Management annual meeting, Naples, FL (United States), 17-20 Jul 1994). Order Number DE94015082. Source: OSTI; NTIS; INIS; GPO Dep.

As part of the Fuel Cycle Facility (FCF) of Argonne National Laboratory's Integral Fast Reactor (IFR) demonstration, a computer-based Mass-Tracking (MTG) System has been developed. The MTG System collects, stores, retrieves and processes data on all operations which directly affect the flow of process material through FCF and supports such activities as process modeling, compliance with operating limits (e.g., criticality safety), material control and accountability and operational information services. Its architecture is client/server, with input and output connections to operator's equipment-control stations on the floor of FCF as well as to terminal sessions. Its heterogeneous database includes a relational-database manager as well as both binary and ASCII data files. The design of the database, and the software that supports it, is based on a model of discrete accountable items distributed in space and time and constitutes a complete historical record of the material processed in FCF. Although still under development, much of the MTG System has been qualified and is in production use.

27531 (ANL/RA/CP–83541) **Measurement control design and performance assessment in the Integral Fast Reactor fuel cycle.** Orechwa, Y.; Bucher, R.G. Argonne National Lab., IL (United States). [1994]. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-940748–54: Institute of Nuclear Materials Management annual meeting, Naples, FL (United States), 17-20 Jul 1994). Order Number DE94016303. Source: OSTI; NTIS; INIS; GPO Dep.

The Integral Fast Reactor (IFR)–consisting of a metal fueled and liquid metal cooled reactor together with an attendant fuel cycle facility (FCF)–is currently undergoing a phased demonstration of the closed fuel cycle at Argonne National Laboratory. The recycle technology is pyrometalurgical based with incomplete fission product separation and all transuranics following plutonium for recycle. The equipment operates in batch mode at 500 to 1,300 C. The materials are highly radioactive and pyrophoric, thus the FCF requires remote operation. Central to the material control and accounting system for the FCF are the balances for mass measurements. The remote operation of the balances limits direct adjustment. The radiation environment requires that removal and replacement of the balances be minimized. The uniqueness of the facility precludes historical data for design and performance assessment. To assure efficient operation of the facility, the design of the measurement control system has called for procedures which assess the performance of the balances in great detail and will support capabilities for the correction of systematic changes in the performance of the balances through software.

27532 (DOE/CH–9404) **Safeguards and Nuclear Materials Management: A view from the DOE Chicago Operations Office.** Healy, F.E.; Ahlberg, C.G. USDOE Chicago Operations Office, Argonne, IL (United States). [1994]. 7p. Sponsored by USDOE, Washington, DC (United States). (CONF-940748–6: Institute of Nuclear Materials Management annual meeting, Naples, FL (United States), 17-20 Jul 1994). Order Number DE94015169. Source: OSTI; NTIS; GPO Dep.

Nuclear Materials Safeguards (also known as Material Control and Accountability or MC&A) and Nuclear Materials Management as practiced within the US Department of Energy (DOE) are separate, but related disciplines with differing goals and objectives. Safeguards and Nuclear Materials Management are closely related through the common use of transaction and inventory reporting data from the Nuclear Materials Management and Safeguards System (NMMSS). Adherence to Nuclear Materials management principals may enhance Nuclear Materials Safeguards, and has the potential to result in savings for both program and safeguards costs. Both the Safeguards and Nuclear Materials Management Programs for the Chicago Operations Office are administered by the Safeguards and Security Division, Safeguards Branch. This paper discusses Safeguards and Materials Management issues within the Chicago Operations Office, some of which relate to problems faced by the DOE complex as a whole.

27533 (DOE/ID–10422-Vol.1) **Weapons-grade plutonium dispositioning: Volume 1: Executive summary.** Parks, D.L.; Sauerbrun, T.J. USDOE Idaho Field Office, Idaho Falls, ID (United States). Jun 1993. 12p. Sponsored by USDOE, Washington, DC (United States);National Academy of Sciences, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE94015246. Source: OSTI; NTIS; INIS; GPO Dep.

The Secretary of Energy requested the National Academy of Sciences (NAS) Committee on International Security and Arms Control to evaluate dispositioning options for weapons-grade plutonium. The Idaho National Engineering Laboratory (INEL) assisted NAS in this evaluation by investigating the technical aspects of the dispositioning options and their capability for achieving plutonium annihilation levels greater than 90%. Additionally, the INEL investigated the feasibility of using plutonium fuels (without uranium) for disposal in existing light water reactors and provided a preconceptual analysis for a reactor specifically designed for destruction of weapons-grade plutonium. This four-volume report was prepared for NAS to document the findings of these studies. Volume 2 evaluates 12 plutonium dispositioning options. Volume 3 considers a concept for a low-temperature, low-pressure, low-power-density, low-coolant-flow-rate light water reactor that quickly destroys plutonium without using uranium or thorium. This reactor concept does not produce electricity and has no other mission than the destruction of plutonium. Volume 4 addresses neutronic performance, fabrication technology, and fuel performance and compatibility issues for zirconium-plutonium oxide fuels and aluminum-plutonium metallic fuels. This volumes gives summaries of Volumes 2–4.

27534 (DOE/ID–10422-Vol.2) **Weapons-grade plutonium dispositioning: Volume 2: Comparison of plutonium disposition options.** Brownson, D.A. (and others); Hanson, D.J.; Blackman, H.S. USDOE Idaho Field Office, Idaho Falls, ID (United States). Jun 1993. 222p. Sponsored by USDOE, Washington, DC (United States);National Academy of Sciences, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE94015247. Source: OSTI; NTIS; INIS; GPO Dep.

The Secretary of Energy requested the National Academy of Sciences (NAS) Committee on International Security and Arms Control to evaluate disposition options for weapons-grade plutonium. The Idaho National Engineering Laboratory (INEL) offered to assist the NAS in this evaluation by investigating the technical aspects of the disposition options and their capability for achieving plutonium annihilation levels greater than 90%. This report was prepared for the NAS to document the gathered information and results from the requested option evaluations. Evaluations were performed for 12 plutonium disposition options involving five reactor and one accelerator-based systems. Each option was evaluated in four technical areas: (1) fuel status, (2) reactor or accelerator-based system status, (3) waste-processing status, and (4) waste disposal status. Based on these evaluations, each concept was rated on its operational capability and time to deployment. A third rating category of option costs could not be performed because of the unavailability of adequate information from the concept sponsors. The four options achieving the highest rating, in alphabetical order, are the Advanced Light Water Reactor with plutonium-based ternary fuel, the Advanced Liquid Metal Reactor with plutonium-based fuel, the Advanced Liquid Metal Reactor with uranium-plutonium-based fuel, and the Modular High Temperature Gas-Cooled Reactor with plutonium-based fuel. Of these four options, the Advanced Light Water Reactor and the Modular High Temperature Gas-Cooled Reactor do not propose reprocessing of their irradiated fuel. Time constraints and lack of detailed information did not allow for any further ratings among these four options. The INEL recommends these four options be investigated further to determine the optimum reactor design for plutonium disposition.

27535 (DOE/ID–10422-Vol.3) **Weapons-grade plutonium dispositioning: Volume 3: A new reactor concept without uranium or thorium for burning weapons-grade plutonium.** Ryskamp, J.M. (and others); Schnitzler, B.G.; Fletcher, C.D. USDOE Idaho Field Office, Idaho Falls, ID (United States). Jun 1993. 132p. Sponsored by USDOE, Washington, DC (United States);National Academy of Sciences, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE94015248. Source: OSTI; NTIS; INIS; GPO Dep.

The National Academy of Sciences (NAS) requested that the Idaho National Engineering Laboratory (INEL) examine concepts that focus only on the destruction of 50,000 kg of weapons-grade plutonium. A concept has been developed by the INEL for a low-temperature, low-pressure, low-power density, low-coolant-flow-rate light water reactor that destroys plutonium quickly without using uranium or thorium. This concept is very safe and could be designed, constructed, and operated in a reasonable time frame. This concept does not produce electricity. Not considering other missions frees the design from the paradigms and constraints used by proponents of other dispositioning concepts. The plutonium destruction design goal is most easily achievable with a large, moderate power reactor that operates at a significantly lower thermal power density than is appropriate for reactors with multiple design goals. This volume presents the assumptions and requirements, a reactor concept overview, and a list of recommendations. The appendices contain detailed discussions on plutonium dispositioning, self-protection, fuel types, neutronics, thermal hydraulics, off-site radiation releases, and economics.

27536 (LA-UR–94-2236) **Design considerations for third party inspection activities for storage facilities.** Metzler, J.F. (USDOE, Washington, DC (United States). Office of Military Applications and Stockpile Support); Zack, N.R.; Hunteman, W.J.; Jaeger, C.D. Los Alamos National Lab., NM (United States). [1994]. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36 ; AC04-94AL85000. (SAND–94-0572C; CONF-940748–4: Institute of Nuclear Materials Management annual meeting, Naples, FL (United States), 17-20 Jul 1994). Order Number DE94014480. Source: OSTI; NTIS; GPO Dep.

Initiatives by the President and the Secretary of available national excess special nuclear for third party inspection and verification required special design requirements to be considered for the reconfigured weapons complex storage facilities. The approach that will be taken in the design and operation will permit controlled access to all nuclear materials and related information that would not disclose or lead to disclosure of classified or proprietary information not obligated by treaty or other agreements. This approach would provide the third party inspectors with the information and capability to access designated materials while minimizing impact upon facility operations. These considerations would also give the federal government the flexibility to add new materials to the excess materials category list in the future. This paper will discuss the safeguards and security design impacts and features that are being anticipated for the storage facilities, both for possible new construction and upgrading existing facilities.

27537 (LA-UR–94-2253) **Status report on the TSA Systems, Ltd., MCA465 gamma-ray confirmation instrument.** Fehlau, P.E.; Rutherford, D.A. Los Alamos National Lab., NM (United

States). [1994]. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-940748–73: Institute of Nuclear Materials Management annual meeting, Naples, FL (United States), 17-20 Jul 1994). Order Number DE94016077. Source: OSTI; NTIS; INIS; GPO Dep.

The TSA Systems, Ltd., MCA465 is hand-portable, low resolution, gamma-ray instrument for confirming special nuclear materials (SNM) and related applications. The instrument evolved from earlier TSA Systems hand-held instruments, and, since its inception in 1991, it has been undergoing cycles of evaluation and then repair or redesign to correct problems. Through the efforts of Los Alamos, Rocky Flats, and TSA Systems, the MCA465 now has achieved commendable progress toward achieving quality performance as a rapid confirmation tool for SNM.

27538 (LA-UR–94-2271) **A deadtime reduction circuit for thermal neutron coincidence counters with Amptek preamplifiers.** Bourret, S.C.; Krick, M.S. Los Alamos National Lab., NM (United States). [1994]. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-940748–72: Institute of Nuclear Materials Management annual meeting, Naples, FL (United States), 17-20 Jul 1994). Order Number DE94016074. Source: OSTI; NTIS; INIS; GPO Dep.

We have developed a deadtime reduction circuit for thermal neutron coincidence counters using Amptek preamplifier/amplifier/discriminator circuits. The principle is to remove the overlap between the output pulses from the Amptek circuits by adding a derandomizer between the Amptek circuits and the shift-register coincidence electronics. We implemented the derandomizer as an Actel programmable logic array; the derandomizer board is small and can be mounted in the high-voltage junction box with the Amptek circuits, if desired. Up to 32 Amptek circuits can be used with one derandomizer. The derandomizer has seven outputs: four groups of eight inputs, two groups of 16 inputs, and one group of 32 inputs. We selected these groupings to facilitate detector ring-ratio measurements. The circuit was tested with the five-ring research multiplicity counter, which has five output signals-one for each ring. The counter's deadtime was reduced from 70 to 30 ns.

27539 (LA-UR–94-2292) **Multivariate diagnostics and anomaly detection for nuclear safeguards.** Burr, T. (Los Alamos National Lab., NM (United States). Safeguards Systems Group); Jones, J.; Wangen, L. Los Alamos National Lab., NM (United States). [1994]. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-940748–44: Institute of Nuclear Materials Management annual meeting, Naples, FL (United States), 17-20 Jul 1994). Order Number DE94016068. Source: OSTI; NTIS; INIS; GPO Dep.

For process control and other reasons, new and future nuclear reprocessing plants are expected to be increasingly more automated than older plants. As a consequence of this automation, the quantity of data potentially available for safeguards may be much greater in future reprocessing plants than in current plants. The authors first review recent literature that applies multivariate Shewhart and multivariate cumulative sum (Cusum) tests to detect anomalous data. These tests are used to evaluate residuals obtained from a simulated three-tank problem in which five variables (volume, density, and concentrations of uranium, plutonium, and nitric acid) in each tank are modeled and measured. They then present results from several simulations involving transfers between the tanks and between the tanks and the environment. Residuals from a no-fault problem in which the measurements and model predictions are both correct are used to develop Cusum test parameters which are then used to test for faults for several simulated anomalous situations, such as an unknown leak or diversion of material from one of the tanks. The leak can be detected by comparing measurements, which estimate the true state of the tank system, with the model predictions, which estimate the state of the tank system as it "should" be. The no-fault simulation compares false alarm behavior for the various tests, whereas the anomalous problems allow one to compare the power of the various tests to detect faults under possible diversion scenarios. For comparison with the multivariate tests, univariate tests are also applied to the residuals.

27540 (LA-UR–94-2293) **Analysis of inventory difference using fuzzy controllers.** Zardecki, A. Los Alamos National Lab., NM (United States). [1994]. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-940748–43: Institute of Nuclear Materials Management annual meeting, Naples, FL (United States), 17-20 Jul 1994). Order Number DE94016067. Source: OSTI; NTIS; INIS; GPO Dep.

The principal objectives of an accounting system for safeguarding nuclear materials are as follows: (a) to provide assurance that all material quantities are present in the correct amount; (b) to provide timely detection of material loss; and (c) to estimate the amount of any loss and its location. In fuzzy control, expert knowledge is encoded in the form of fuzzy rules, which describe recommended actions for different classes of situations represented by fuzzy sets. The concept of a fuzzy controller is applied to the forecasting problem in a time series, specifically, to forecasting and detecting anomalies in inventory differences. This paper reviews the basic notion underlying the fuzzy control systems and provides examples of application. The well-known material-unaccounted-for diffusion plant data of Jaech are analyzed using both feedforward neural networks and fuzzy controllers. By forming a deference between the forecasted and observed signals, an efficient method to detect small signals in background noise is implemented.

27541 (LA-UR–94-2312) **The use of modern databases in managing nuclear material inventories.** Behrens, R.G. (Los Alamos National Lab., NM (United States). Nuclear Materials and Reconfiguration Technologies Program Office). Los Alamos National Lab., NM (United States). [1994]. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-940748–45: Institute of Nuclear Materials Management annual meeting, Naples, FL (United States), 17-20 Jul 1994). Order Number DE94016063. Source: OSTI; NTIS; INIS; GPO Dep.

The need for a useful nuclear materials database to assist in the management of nuclear materials within the Department of Energy (DOE) Weapons Complex is becoming significantly more important as the mission of the DOE Complex changes and both international safeguards and storage issues become drivers in determining how these materials are managed. A well designed nuclear material inventory database can provide the Nuclear Materials Manager with an essential cost effective tool for timely analysis and reporting of inventories. This paper discusses the use of databases as a management tool to meet increasing requirements for accurate and timely information on nuclear material inventories and related information. From the end user perspective, this paper discusses the rationale, philosophy, and technical requirements for an integrated database to meet the needs for a variety of users such as those working in the areas of Safeguards, Materials Control and Accountability (MC&A), Nuclear Materials Management, Waste Management, materials processing, packaging and inspection, and interim/long term storage.

27542 (LA-UR–94-2320) **LANMAS core: Update and current directions.** Clabom, J. (Los Alamos National Lab., NM (United States). Safeguards Systems Group); Alvarado, A. Los Alamos National Lab., NM (United States). [1994]. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-940748–41: Institute of Nuclear Materials Management annual meeting, Naples, FL (United States), 17-20 Jul 1994). Order Number DE94016058. Source: OSTI; NTIS; INIS; GPO Dep.

Local Area Network Material Accountability System (LANMAS) core software will provide the framework of a material accountability system. LANMAS is a network-based nuclear material accountability system. It tracks the movement of material throughout a site and generates the required reports on material accountability. LANMAS will run in a client/server mode. The database of material type and location will reside on the server, while the user interface runs on the client. The user interface accesses the server via a network. The LANMAS core can be used as the foundation for building required Materials Control and Accountability (MC&A) functionality at any site requiring a new MC&A system. An individual site will build on the LANMAS core by supplying site-specific software. This paper will provide an update on the current LANMAS development activities and discuss the current direction of the LANMAS project.

27543 (LA-UR–94-2374) **Computer-determined assay time based on preset precision.** Foster, L.A. (Los Alamos National

Lab., NM (United States). Nuclear Materials Measurement and Accountability); Hagan, R.; Martin, E.R.; Wachter, J.R.; Bonner, C.A.; Malcom, J.E. Los Alamos National Lab., NM (United States). [1994]. 17p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-940748–66: Institute of Nuclear Materials Management annual meeting, Naples, FL (United States), 17-20 Jul 1994). Order Number DE94016157. Source: OSTI; NTIS; INIS; GPO Dep.

Most current assay systems for special nuclear materials (SNM) operate on the principle of a fixed assay time which provides acceptable measurement precision without sacrificing the required throughput of the instrument. Waste items to be assayed for SNM content can contain a wide range of nuclear material. Counting all items for the same preset assay time results in a wide range of measurement precision and wastes time at the upper end of the calibration range. A short time sample taken at the beginning of the assay could optimize the analysis time on the basis of the required measurement precision. To illustrate the technique of automatically determining the assay time, measurements were made with a segmented gamma scanner at the Plutonium Facility of Los Alamos National Laboratory with the assay time for each segment determined by counting statistics in that segment. Segments with very little SNM were quickly determined to be below the lower limit of the measurement range and the measurement was stopped. Segments with significant SNM were optimally assays to the preset precision. With this method the total assay time for each item is determined by the desired preset precision. This report describes the precision-based algorithm and presents the results of measurements made to test its validity.

27544 (LA-UR–94-2375) **Comparison of three gamma ray isotopic determination codes: FRAM, MGA, and TRIFID.** Cremers, T.L.; Malcom, J.E.; Bonner, C.A. Los Alamos National Lab., NM (United States). [1994]. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-940748–59: Institute of Nuclear Materials Management annual meeting, Naples, FL (United States), 17-20 Jul 1994). Order Number DE94016295. Source: OSTI; NTIS; INIS; GPO Dep.

The determination of the isotopic distribution of plutonium and the americium concentration is required for the assay of nuclear material by calorimetry or neutron coincidence counting. The isotopic information is used in calorimetric assay to compute the effective specific power from the measured isotopic fractions and the known specific power of each isotope. The effective specific power is combined with the heat measurement to obtain the mass of plutonium in the assayed nuclear material. The response of neutron coincidence counters is determined by the ^{240}Pu isotopic fraction with contributions from the other even plutonium isotopes. The effect of the ^{240}Pu isotopic fraction and the other neutron contributing isotopes are combined as ^{240}Pu effective. This is used to calculate the mass of nuclear material from the neutron counting data in a manner analogous to the effective specific power in calorimeter. Comparisons of the precision and accuracy of calorimetric assay and neutron coincidence counting often focus only on the precision and accuracy of the heat measurement (calorimetry) compared to the precision and accuracy of the neutron coincidence counting statistics. The major source of uncertainty for both calorimetric assay and neutron coincidence counting often lies in the determination of the plutonium isotopic distribution ad determined by gamma ray spectroscopy. Thus, the selection of the appropriate isotopic distribution code is of paramount importance to good calorimetric assay and neutron coincidence counting. Three gamma ray isotopic distribution codes, FRAM, MGA, and TRIFID have been compared at the Los Alamos Plutonium Facility under carefully controlled conditions of similar count rates, count times, and ^{240}Pu isotopic fraction.

27545 (LA-UR–94-2395) **An anomaly detector applied to a materials control and accounting system.** Whiteson, R. (Los Alamos National Lab., NM (United States)); Kelso, F.; Baumgart, C.; Tunnell, T.W. Los Alamos National Lab., NM (United States). [1994]. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-940748–70: Institute of Nuclear Materials Management annual meeting, Naples, FL (United States), 17-20 Jul 1994). Order Number DE94016286. Source: OSTI; NTIS; INIS; GPO Dep.

Large amounts of safeguards data are automatically gathered and stored by monitoring instruments used in nuclear chemical processing plants, nuclear material storage facilities, and nuclear fuel fabrication facilities. An integrated safeguards approach requires the ability to identify anomalous activities or states in these data. Anomalies in the data could be indications of error, theft, or diversion of material. The large volume of the data makes analysis and evaluation by human experts very tedious, and the complex and diverse nature of the data makes these tasks difficult to automate. This paper describes the early work in the development of analysis tools to automate the anomaly detection process. Using data from accounting databases, the authors are modeling the normal behavior of processes. From these models they hope to be able to identify activities or data that deviate from that norm. Such tools would be used to reveal trends, identify errors, and recognize unusual data. Thus the expert's attention can be focused directly on significant phenomena.

27546 (LA-UR–94-2417) **Design and fabrication of 55-gallon drum shuffler standards.** Long, S.M.; Hsue, F.; Hoth, C.; Fernandez, R.; Bjork, C.; Sprinkle, J. Los Alamos National Lab., NM (United States). [1994]. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-940748–60: Institute of Nuclear Materials Management annual meeting, Naples, FL (United States), 17-20 Jul 1994). Order Number DE94016290. Source: OSTI; NTIS; INIS; GPO Dep.

To analyze waste with varying levels of nuclear material, suitable standards are needed to calibrate analytical instrumentation. At the Los Alamos Plutonium Facility, the authors have designed and fabricated a single drum standard for a passive-active neutron counter (shuffler). The standard is modified simply by adding or subtracting plutonium of uranium cylinders to adapt to a range of nuclear material. The plutonium or uranium oxide was placed into small cylindrical containers (1-in. diameter by 5-in. long) and diluted with diatomaceous earth. The cylinders were welded closed and removed from the glove box environment without any external contamination. The containers were leak tested and then placed on a segmented gamma scanner to assure homogeneous distribution of the nuclear material. The cylinders are now placed into the drum to achieve the needed ranges for calibration of the instruments.

27547 (LA-UR–94-2441) **Installation and calibration of the oversized low-level package counter at Los Alamos National Laboratory.** Long, S.M.; Langner, D.G.; Foster, L.A.; Malcom, J.E. Los Alamos National Lab., NM (United States). [1994]. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-940748–64: Institute of Nuclear Materials Management annual meeting, Naples, FL (United States), 17-20 Jul 1994). Order Number DE94016177. Source: OSTI; NTIS; INIS; GPO Dep.

With the importance of safeguards in production facilities, the Los Alamos National Laboratory Plutonium Facility has installed a neutron slab counter to facilitate the measurement of low-level waste packaged in 4 ft x 4 ft x 8 ft crates. In the past, oversized packages were measured by a gamma technique to assess holdup. The measurement was time-consuming and cumbersome, and the efficiency was questionable. The slab counter has alleviated the time and efficiency problems of the gamma measurement. The counter consists of four slab counters, each slab containing twenty 60-in. long helium-3 tubes embedded in 3.5 in. thick polyethylene slab. The detectors are shielded from room background by an additional 3.5 in. of polyethylene. The 4 ft 6 in. by 7 ft 6 in by 8 in. steel encased slabs are arranged around a 4 ft 6 in. x 22 ft conveyor system with two slabs on each side of the conveyor. The slabs are located on one end of the conveyor, with the end open to facilitate waste crate loading by forklift. The system was calibrated with a ^{252}Cf source and placed in various locations throughout a mock waste crate. The mock calibration waste crate can be loaded with waste material to simulate waste crates generated in the facility.

27548 (LA-UR–94-2444) **MC&A policy issues for international inspections at DOE nuclear facilities.** Crawford, D.W. (Dept. of Energy, Washington, DC (United States). Office of Safeguards and Security); Zack, N.R. Los Alamos National Lab., NM

(United States). [1994]. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-940748–69: Institute of Nuclear Materials Management annual meeting, Naples, FL (United States), 17-20 Jul 1994). Order Number DE94016205. Source: OSTI; NTIS; INIS; GPO Dep.

Recent initiatives and executive decisions within the US have included an offer to place certain special nuclear materials from the former weapons stockpile under international safeguards inspections. The nuclear materials at issue are excess materials; other materials characterized as strategic reserve will not be subject to these international activities. Current Department of Energy requirements and procedures to account for and control these nuclear materials may need to be modified to accommodate these inspections. Safeguards issues, such as physical inventory frequency and verification requirements, may rise from the collateral safeguards activities in support of both domestic and international safeguards. This paper will discuss Office of Safeguards and Security policy and views on these international inspection activities at former nuclear weapons facilities, including implications for current domestic safeguards approaches currently implemented at these facilities.

27549 (LA-UR–94-2446) **Graded safeguards: Determination of attractiveness levels for special nuclear material.** Wilkey, D.D. (Los Alamos National Lab., NM (United States). Safeguards Systems Group); Crawford, D.W. Los Alamos National Lab., NM (United States). [1994]. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-940748–58: Institute of Nuclear Materials Management annual meeting, Naples, FL (United States), 17-20 Jul 1994). Order Number DE94016208. Source: OSTI; NTIS; GPO Dep.

The DOE graded safeguards approach–as described in DOE Order 5633.3A, Control and Accountability of Nuclear Materials, and its guide–requires the determination of category levels of nuclear material locations to establish protection requirements for these locations. A critical parameter related to category determination is knowledge of the attractiveness level of the nuclear material with respect to use in a nuclear explosive device. DOE Order 5633.3A and its guide provide the policy basis for determining the attractiveness level of various forms and types of special nuclear material (SNM); however, these requirements and guidance are necessarily general and sometimes based on arbitrary criteria. Currently, there are large quantities of nuclear material on inventory within the DOE that need attractiveness determinations to ensure appropriate protection controls. Specific forms of these materials include materials in matrices requiring special processing, irradiated SNM that does not meet criteria for self-protecting, low concentration SNM, SNM as numerous small items, and bulk non-portable SNM items. This paper discusses the technical basis for applying material concentration limits for solids and liquids that can influence the various factors and criteria affecting the attractiveness level of SNM. Holdup and rollup considerations for determining category levels will be discussed as well.

27550 (LA-UR–94-2447) **Material balance areas and frequencies for large reprocessing plants.** Burr, T. (Los Alamos National Lab., NM (United States). Safeguards Systems Group). Los Alamos National Lab., NM (United States). [1994]. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-940748–68: Institute of Nuclear Materials Management annual meeting, Naples, FL (United States), 17-20 Jul 1994). Order Number DE94016209. Source: OSTI; NTIS; INIS; GPO Dep.

It has long been recognized that facilities with a large nuclear material throughput will probably not meet the International Atomic Energy Agency (IAEA) goal for detecting trickle diversion of plutonium over periods of about one year. The reason is that measurement errors for plutonium concentration and for liquid volume are often approximately relative over a fairly wide range of true values. Therefore, large throughput facilities will tend to have large uncertainties assigned to their annual throughput. By the same argument, if frequent balances are performed over small material balance areas, then the uncertainty associated with each balance period for each balance area will be small. However, trickle diversion would still be difficult to detect statistically. Because the IAEA will soon be faced with safeguarding a new large-scale reprocessing plant in Japan, it is timely to reconsider the advantages and disadvantages of performing frequent material balances over small balance areas (individual tanks where feasible). Therefore, in this paper the authors present some simulation results to study the effect of balance frequency on loss detection probability, and further simulation results to study possibilities introduced by choosing small balance areas. They conclude by recommending frequent balances over small areas.

27551 (LA-UR–94-2475) **Evaluation of low-level waste analysis using the MADAM system.** Foster, L.A. (Los Alamos National Lab., NM (United States). Nuclear Materials Measurement and Accountability); Wachter, J.R.; Hagan, R.C. Los Alamos National Lab., NM (United States). [1994]. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-940748–53: Institute of Nuclear Materials Management annual meeting, Naples, FL (United States), 17-20 Jul 1994). Order Number DE94016169. Source: OSTI; NTIS; INIS; GPO Dep.

Previously, the important hardware features and capabilities for the Multiple Assay Dual Analysis Measurement (MADAM) system were reported. MADAM is a combined low-level and transuranic waste assay system. The system integrated commercially available Segmented Gamma Scanner (SGS) capability together with multi-energy X-ray and gamma-ray analysis to measure these two waste forms. In addition, the system incorporated a small neutron slab detector to satisfy safeguards concerns and high resolution gamma-ray isotopics analysis proficiency. Since delivery of the system to this facility, an evaluation of its low-level waste measurement performance has been conducted using a set of specially constructed NIST-traceable standards. The evaluation studied existing analysis algorithms, matrix and attenuation effects, source position as a function of detector response, instrument stability, and sensitivity. Based on these studies, several modifications to the existing analysis algorithms have been performed, new correction factors for matrix attenuation have been devised, and measurement error estimates have been calculated and incorporated into the software. This report discusses the results of the evaluation program and the software modifications that have been developed.

27552 (LA-UR–94-2482) **Point-source calibration of a segmented gamma-ray scanner.** Sheppard, G.A. (Los Alamos National Lab., NM (United States). Safeguards Assay Group); Piquette, E.C. Los Alamos National Lab., NM (United States). [1994]. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-940748–55: Institute of Nuclear Materials Management annual meeting, Naples, FL (United States), 17-20 Jul 1994). Order Number DE94016092. Source: OSTI; NTIS; INIS; GPO Dep.

For a conventional segmented gamma-ray scanner (SGS) in which the sample is rotated continuously within a fixed detector field of view, the data will not support alternatives to the assumption that the gamma-emitting nuclides and the matrix in which they reside are uniformly distributed. This homogeneity assumption permits the geometry of samples and calibration standards to be approximated by that of a non attenuating line source on the axis of rotation. Other common SGS assumptions are that the detector is perfectly collimated, that its response is flat over its field of view, and that it can be approximated adequately by a line. All of these assumption have led to a preference for homogeneous calibration standards. Preparation and certification of such calibration standards are usually difficult and expensive. Storage and transportation of SGS standards can be inconvenient or even quite troublesome. The authors have proposed and tested an alternative method of SGS calibration that only requires a point-source standard. The proposed technique relies on the empirical determination of a normalized two-dimensional detector response and the measurement of the count rate from a point-source standard located at the response apex. With these data, the system's response to a distributed, homogeneous samples can be predicted using numerical integration. Typical biases measured using a commercially available SGS calibrated with a point source have been less than 2%.

27553 (LA-UR–94-2531) **An efficient network for interconnecting remote monitoring instruments and computers.** Halbig, J.K.; Gainer, K.E.; Klosterbuer, S.F. Los Alamos National Lab., NM

(United States). [1994]. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-940748–67: Institute of Nuclear Materials Management annual meeting, Naples, FL (United States), 17-20 Jul 1994). Order Number DE94016213. Source: OSTI; NTIS; INIS; GPO Dep.

Remote monitoring instrumentation must be connected with computers and other instruments. The cost and intrusiveness of installing cables in new and existing plants presents problems for the facility and the International Atomic Energy Agency (IAEA). The authors have tested a network that could accomplish this interconnection using mass-produced commercial components developed for use in industrial applications. Unlike components in the hardware of most networks, the components–manufactured and distributed in North America, Europe, and Asia–lend themselves to small and low-powered applications. The heart of the network is a chip with three microprocessors and proprietary network software contained in Read Only Memory. In addition to all nonuser levels of protocol, the software also contains message authentication capabilities. This chip can be interfaced to a variety of transmission media, for example, RS-485 lines, fiber topic cables, rf waves, and standard ac power lines. The use of power lines as the transmission medium in a facility could significantly reduce cabling costs.

27554 (SAND–94-0571C) **Physical protection technologies for the reconfigured weapons complex.** Jaeger, C.D. Sandia National Labs., Albuquerque, NM (United States). [1994]. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. (CONF-940748–42: Institute of Nuclear Materials Management annual meeting, Naples, FL (United States), 17-20 Jul 1994). Order Number DE94015786. Source: OSTI; NTIS; GPO Dep.

Sandia National Laboratories was a memtier of the Weapons Complex Reconfiguration (WCR) Safeguards and Security (S&S) team providing assistance to the Department of Energy's (DOE) Office of Weapons Complex Reconfigaration. New and improved S&S concepts, approaches and technologies were needed to support both new and upgraded facilities. Physical protection technologies used in these facilities were to use proven state-of-the-art systems in such areas as image processing, alarm communications and display, entry control, contraband detection, intrusion detection and video assessment, access delay, automation and robotics, and various insider protection systems. Factors considered in the selection of these technologies were protection against the design basis threat, reducing S&S life-cycle costs, automation of S&S functions to minimize operational costs, access to critical assets and exposure of people to hazardous environments, increasing the amount of delay to an outsider adversary and having reliable and maintainable systems. This paper will discuss the S&S issues, requirements, technology opportunities and needs. Physical protection technologies and systems considered in the design effort of the Weapons Complex Reconfiguration facilities will be reviewed.

27555 (SAND–94-0759C) **Insider protection technology developments.** Foesch, J.; Bortniak, P.; Waddoups, I. Sandia National Labs., Albuquerque, NM (United States). [1994]. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. (CONF-940748–11: Institute of Nuclear Materials Management annual meeting, Naples, FL (United States), 17-20 Jul 1994). Order Number DE94015791. Source: OSTI; NTIS; GPO Dep.

Sandia National Laboratories evaluates and develops new techniques and technologies to ensure the integrity of special nuclear material (SNM) against potential insider threats. We have evaluated several types of sensor technologies and subsystems to monitor and/or track materials and personnel. This past year's effort has been directed at characterizing commercial developments that meet the Department of Energy's (DOE) needs in some of these areas. Some of these evaluations are complete and some are still in progress. This paper discusses our work with infrared light (IR), radio frequency (RF), and RF proximity technologies. After these technologies are judged to be applicable to DOE's needs, we incorporate them into the generic, real time, personnel tracking and material monitoring system.

27556 (SAND–94-1068C) **Intrusion detection sensor testing tools.** Hayward, D.R. Sandia National Labs., Albuquerque, NM (United States). [1994]. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. (CONF-940748–10: Institute of Nuclear Materials Management annual meeting, Naples, FL (United States), 17-20 Jul 1994). Order Number DE94015759. Source: OSTI; NTIS; GPO Dep.

Intrusion detection sensors must be frequently tested to verify that they are operational, and they must be periodically tested to verify that they are functioning at required performance levels. Concerns involving this testing can include: The significant amount of manpower required, inconsistent results due to variability in methods and personnel, exposure of personnel to hazardous environments, and difficulty in obtaining access to the areas containing some of the intrusion sensors. To address these concerns, the Department of Energy directed Sandia National Labs. to develop intrusion detection sensor testing tools. Over the past two years Sandia has developed several sensor testing tool prototypes. This paper describes the evolution of an exterior intrusion detection sensor tester and automatic data logger, and also describes various interior intrusion detection sensor test fixtures that can be remotely activated to simulate an intruder.

27557 (SAND–94-1351C) **An image processing system for the monitoring of special nuclear material and personnel.** Thai, T.; Carlson, J.; Urenda, D.; Cooley, T. Sandia National Labs., Albuquerque, NM (United States). [1994]. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. (CONF-9410105–8: Institute of Electrical and Electronics Engineers international Carnahan conference on security technology, Albuquerque, NM (United States), 12-14 Oct 1994). Order Number DE94015773. Source: OSTI; NTIS; GPO Dep.

An important aspect of insider protection in production facilities is the monitoring of the movement of special nuclear material (SNM) and personnel. One system developed at Sandia National Labs for this purpose is the Personnel and Material Tracking System (PAMTRAK). PAMTRAK can intelligently integrate different sensor technologies and the security requirements of a facility to provide a unique capability in monitoring and tracking SNM and personnel. Currently many sensor technologies are used to track the location of personnel and SNM inside a production facility. These technologies are generally intrusive; they require special badges be worn by personnel, special tags be connected to material, and special detection devices be mounted in the area. Video technology, however, is non-intrusive because it does not require that personnel wear special badges or that special tags be attached to SNM. Sandia has developed a video-based image processing system consisting of three major components: the Material Monitoring-Subsystem (MMS), the Personnel Tracking Subsystem (PTS) and the Item Recognition Subsystem (IRS). The basic function of the MMS is to detect movements of SNM, that occur in user-defined regions of interest (ROI) from multiple cameras; these ROI can be of any shape and size. The purpose of the PTS is to track location of personnel in an area using multiple cameras. It can also be used to implement the two-person rule or to detect unauthorized personnel in a restricted area. Finally, the IRS can be used for the recognition and inventory of SNM in a working area. It can also generate a log record on the status of each SNM. Currently the MMS is integrated with PAMTRAK to complement other monitoring technologies in the system. The paper will discuss the system components and their implementations, and describe current enhancements as well as future work.

27558 (SAND–94-1922C) **Application of network technology to Remote Monitoring System.** Johnson, C.S. (Sandia National Labs., Albuquerque, NM (United States)); Sorokowski, D.L.; Veevers, K. Sandia National Labs., Albuquerque, NM (United States). [1994]. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. (CONF-940748–13: Institute of Nuclear Materials Management annual meeting, Naples, FL (United States), 17-20 Jul 1994). Order Number DE94015794. Source: OSTI; NTIS; INIS; GPO Dep.

The Australian Safeguards Office (ASO) and the US Department of Energy (DOE) have sponsored work under a bilateral agreement to implement a Remote Monitoring System (RMS) at an Australian nuclear site operated by the Australian Nuclear Science and Technology Organization (ANSTO). The RMS, designed by Sandia

National Laboratories (SNL), was installed in February 1994 at the Dry Spent Fuel Storage Facility (DSFSF) located at Lucas Heights, Australia. The RMS was designed to test a number of different concepts that would be useful for unattended remote monitoring activities. The DSFSF located in Building 27 is a very suitable test site for a RMS. The RMS uses a network of low cost nodes to collect data from a number of different sensors and security devices. Different sensors and detection devices have been installed to study how they can be used to complement each other for C/S applications. The data collected from the network will allow a comparison of how the various types of sensors perform under the same set of conditions. A video system using digital compression collects digital images and stores them on a hard drive and a digital optical disk. Data and images from the storage area are remotely monitored via telephone from Canberra, Australia and Albuquerque, NM, USA. These remote monitoring stations operated by ASO and SNL respectively, can retrieve data and images from the RMS computer at the DSFSF. The data and images are encrypted before transmission. The Remote Monitoring System field tests have been operational for six months with good test results. Sensors have performed well and the digital images have excellent resolution. The hardware and software have performed reliably without any major difficulties. This paper summarizes the highlights of the prototype system and the ongoing field tests.

27559 (SAND–94-1977C) **Sticky foam technology for less-than-lethal force situations.** Goolsby, T.D. Sandia National Labs., Albuquerque, NM (United States). [1994]. 3p. Sponsored by Department of Justice, Washington, DC (United States). DOE Contract AC04-94AL85000. (CONF-9410105–7: Institute of Electrical and Electronics Engineers international Carnahan conference on security technology, Albuquerque, NM (United States), 12-14 Oct 1994). Order Number DE94015737. Source: OSTI; NTIS; GPO Dep.

Sticky foam is an extremely tacky, tenacious material used to entangle and impair an individual. It was developed at Sandia National Laboratories (SNL) in the late 1970's for usage in nuclear safeguards and security applications. In late 1992, the National Institute of Justice (NIJ), the research arm of the Department of Justice, began a project with SNL to determine the applicability of sticky foam for law enforcement usage. The objectives of the project were to develop a dispenser capable of firing sticky foam, to conduct an extensive toxicology review of sticky foam (formulation SF-283), to test the developed dispenser and sticky foam effectiveness on SNL volunteers acting out prison and law enforcement scenarios, and to have the dispenser and sticky foam further evaluated by correctional representatives. This paper discusses the results of the project.

27560 (WSRC-MS–94-0102) **Near-real-time MC&A assessments.** Johnson, H.D.; Rodriquez, M.P.; Wolf, D.A. Westinghouse Savannah River Co., Aiken, SC (United States). [1994]. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035. (CONF-940748–17: Institute of Nuclear Materials Management annual meeting, Naples, FL (United States), 17-20 Jul 1994). Order Number DE94015555. Source: OSTI; NTIS; GPO Dep.

At the Savannah River Site, material control and accountability (MC&A) assessments are performed annually on Category 1 and 2 facilities, and biennially on Category 3 and 4 facilities. Assessors frequently find that deficiencies identified and corrected during one assessment resurface a year or two later due to reorganizations, consolidation of material, reductions in force, etc., and must be addressed again. This assessment interval can also allow an insignificant problem to reach immense proportions before it is identified. This paper proposes a method of continually assessing facility MC&A programs and requirements through performance testing that is already required by DOE Orders. Through performance testing, MC&A critical system elements are constantly monitored and flagged when unsatisfactory results occur. Problems can be identified as they transpire, and then corrected before they become significant. This enables assessments to become "near-real-time." Corrective actions can be validated almost immediately and are revalidated every time the test is conducted. This paper proposes a more cost-effective, timely method of conducting MC&A assessments through the implementation of the required performance testing program.

27561 (WSRC-MS–94-0106) **Implementation of performance testing to support an insider vulnerability assessment at the Savannah River Site.** Monson, R.W. Westinghouse Savannah River Co., Aiken, SC (United States). [1994]. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035. (CONF-940748–22: Institute of Nuclear Materials Management annual meeting, Naples, FL (United States), 17-20 Jul 1994). Order Number DE94015590. Source: OSTI; NTIS; INIS; GPO Dep.

Category 1 and 2 facilities must have an insider vulnerability assessment (VA) developed per DOE Order 5633.3A. This VA identifies the critical system elements that must be tested by the performance testing program. Once this VA is developed and all necessary upgrades to the critical system elements are implemented, the upgrades must be performance tested (PT). Per DOE Order 5633.3A, each facility has a safeguards an security system to provide defense-in-depth. The safeguards and security system assures that the level of risk is not increased if a single element is defeated. The VA determines both the amount of risk associated with a single critical element and if the increase in risk is acceptable. Compensatory measures and upgrades to the critical system elements are made when the increase in risk exceeds an acceptable level. This paper will describe the methodology used to performance test compensatory measures and upgrades resulting from an insider VA for a Category 1 process facility at the Savannah River Site. Outsider threats are not considered in this paper. They are the responsibility of the Protective Force and are performance tested by that organization.

27562 (WSRC-RP–93-1262) **Use of Savannah River Site facilities for blend down of highly enriched uranium.** Bickford, W.E.; McKibben, J.M. Westinghouse Savannah River Co., Aiken, SC (United States). Feb 1994. 50p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035. Order Number DE94015553. Source: OSTI; NTIS; INIS; GPO Dep.

Westinghouse Savannah River Company was asked to assess the use of existing Savannah River Site (SRS) facilities for the conversion of highly enriched uranium (HEU) to low enriched uranium (LEU). The purpose was to eliminate the weapons potential for such material. Blending HEU with existing supplies of depleted uranium (DU) would produce material with less than 5% U-235 content for use in commercial nuclear reactors. The request indicated that as much as 500 to 1,000 MT of HEU would be available for conversion over a 20-year period. Existing facilities at the SRS are capable of producing LEU in the form of uranium trioxide (UO_3) powder, uranyl nitrate [$UO_2(NO_3)_2$] solution, or metal. Additional processing, and additional facilities, would be required to convert the LEU to uranium dioxide (UO_2) or uranium hexafluoride (UF_3), the normal inputs for commercial fuel fabrication. This study's scope does not include the cost for new conversion facilities. However, the low estimated cost per kilogram of blending HEU to LEU in SRS facilities indicates that even with fees for any additional conversion to UO_2 or UF_6, blend-down would still provide a product significantly below the spot market price for LEU from traditional enrichment services. The body of the report develops a number of possible facility/process combinations for SRS. The primary conclusion of this study is that SRS has facilities available that are capable of satisfying the goals of a national program to blend HEU to below 5% U-235. This preliminary assessment concludes that several facility/process options appear cost-effective. Finally, SRS is a secure DOE site with all requisite security and safeguard programs, personnel skills, nuclear criticality safety controls, accountability programs, and supporting infrastructure to handle large quantities of special nuclear materials (SNM).

0560 Legislation and Regulations

Refer also to citation(s) 27340, 27341, 27344, 27377, 27398, 27489, 27658, 27681, 28547, 28562, 28563, 28564, 28565

07 ISOTOPE AND RADIATION SOURCE TECHNOLOGY

Refer also to citation(s) 28891

0701 Physical Isotope Separation

Refer also to citation(s) 27686, 28097

27563 (JAERI-M–94-012) **Structure and manual of radioisotope-production data base, ISOP.** Hata, Kentaro (Japan Atomic Energy Research Inst., Tokai, Ibaraki (Japan). Tokai Research Establishment); Terunuma, Kusuo. Japan Atomic Energy Research Inst., Tokyo (Japan). Feb 1994. 43p. (In Japanese). Order Number DE94785197. Source: OSTI; NTIS; INIS.

We planned on collecting the information of radioisotope production which was obtained from research works and tasks at the Department of Radioisotopes in JAERI, and constructed a prototype data base ISOP after discussion of the kinds and properties of the information available for radioisotope production. In this report the structure and the manual of ISOP are described. (author).

27564 (RL-SEP–939-RD-Del.) **HAPO tritium production facilities study - 1958 - study reports numbers 1 and 2.** Kesel, G.P.; Koontz, W.H.; Smiset, O.V.; Denollander, W.R. Pacific Northwest Lab., Richland, WA (United States). 12 Nov 1968. 38p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE94016495. Source: OSTI; NTIS; GPO Dep.

Start of the development of new processes to extract mint can be a gradual program. The most promising of early results lies in the area of Isotopic Purification. Steps have been initiated to start development work on separation and purification of mint gas by chromatography. This method has the added advantage over columns as three gases, hydrogen, deuterium and mint may be separated in one operation. Should it appear that this method may fail, a second approach would be development of a packed column. Even with a change of the basic extraction process, isotopic purification is required and the improvement of such facilities would serve to provide the product at a reduced initial capital cost as well as reduced extraction cost. Work can proceed at the same time with development of a dissolution process. As noted in Appendix I, a unit extraction savings in the order of 20 percent can be expected since, in the most simple form, expensive furnace pots would be replaced by inexpensive crucibles.

0702 Radiation Sources

Refer also to citation(s) 27910, 28216, 28217

27565 (FRCEA-TH–398) **Theoretical and experimental study of multilayers interferential reflectors for neutrons: SUPERMIRRORS.** Maaza, M. Laboratoire Leon Brillouin (LLB) - Centre d'Etudes de Saclay, 91 - Gif-sur-Yvette (France); Paris-6 Univ., 75 (France). Oct 1991. 323p. (In French). Order Number DE94632478. Source: OSTI; NTIS (US Sales Only); INIS.

The aim of this study was the realization of (Ni-Ti) supermirror neutron guides which have good performances both optically and morphologically. To achieve this, we closed in gradually to evaluate better fundamental and technological problems. In the beginning, the study was oriented towards decoupling the effects of the different defects in the (Ni-Ti) multilayer and to tackle them one by one. In the first part, we present the classical neutrons guides and their limits and compare them with the supermirror guides and their advantages. Next, we describe the neutron optics formalism in analogy with electromagnetic classical optics, in particular X ray radiation. We have essentially employed the Grazing Angle Neutron Reflectometry technique for the investigation of our samples. These experimental results have been complemented by those of other surface investigation techniques: -optical, magnetic, electronic and ionic ones. The results were in almost overall agreement. More precisely, the neutron reflectivity profiles were treated by using the Abeles matrix formalism for an electromagnetic wave in S polarized state. In the third time, we present the whole of the experimental results obtained. The combination of the latter two effects (hydrogenation of titanium and carburation of nickel) which has not yet been achieved constitutes a direct continuation of this work. This could improve even further both the neutron reflectivity and the critical angle by coupling Mezei-Dagleish and Hayter-Mook stacks. A simulation has shown that a stack of this type consists of 15 bilayers (Ni_xC-TiH_2) has the same reflectivity as a stack of 60 bilayers (Ni-Ti). (author).

27566 (LA-UR–93-4305) **X-ray production with sub-picosecond laser pulses.** Schappert, G.T.; Cobble, J.A.; Fulton, R.D.; Kyrala, G.A. Los Alamos National Lab., NM (United States). [1993]. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-941046–1: 11. international workshop on laser interaction and related plasma phenomena, Monterey, CA (United States), Oct 1994). Order Number DE94004979. Source: OSTI; NTIS; GPO Dep.

The interaction of intense, sub-picosecond laser pulses with solid targets produces intense picosecond x-ray pulses. With focused laser pulses of several 10^{18} W/cm^2, He-like and H-like line radiation from targets such as aluminum and silicon has been produced. The energy conversion efficiency from the laser pulse energy to the 1–2 keV line x-rays is nearly one percent. The duration of the line x-ray radiation is of the order of ten picoseconds, although this may be an upper estimate because of the temporal resolution of the x-ray streak camera. The spatial extent of the x-ray source region is only slightly larger than the laser focal spot, or about 10 μm in diameter. With these characteristics, such x-ray sources emit an intensity of nearly 10^{14} W/cm^2. Experiments and modeling which led to the above conclusions will be discussed.

27567 (UCRL-JC–117450) **Tomographic image reconstruction and rendering with texture-mapping hardware.** Azevedo, S.G. (Lawrence Livermore National Lab., CA (United States)); Cabral, B.K.; Foran, J. Lawrence Livermore National Lab., CA (United States). Jul 1994. 14p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-940723–4: Annual meeting of the Society of Photo-Optical Instrumentation Engineers, San Diego, CA (United States), 24-29 Jul 1994). Order Number DE94015191. Source: OSTI; NTIS; INIS; GPO Dep.

The image reconstruction problem, also known as the inverse Radon transform, for x-ray computed tomography (CT) is found in numerous applications in medicine and industry. The most common algorithm used in these cases is filtered backprojection (FBP), which, while a simple procedure, is time-consuming for large images on any type of computational engine. Specially-designed, dedicated parallel processors are commonly used in medical CT scanners, whose results are then passed to graphics workstation for rendering and analysis. However, a fast direct FBP algorithm can be implemented on modern texture-mapping hardware in current high-end workstation platforms. This is done by casting the FBP algorithm as an image warping operation with summing. Texture-mapping hardware, such as that on the Silicon Graphics Reality Engine (TM), shows around 600 times speedup of backprojection over a CPU-based implementation (a 100 Mhz R4400 in this case). This technique has the further advantages of flexibility and rapid programming. In addition, the same hardware can be used for both image reconstruction and for volumetric rendering. The techniques can also be used to accelerate iterative reconstruction algorithms. The hardware architecture also allows more complex operations than straight-ray backprojection if they are required, including fan-beam, cone-beam, and curved ray paths, with little or no speed penalties.

0703 Isotopic Power Supplies

Refer also to citation(s) 28002

27568 (ORNL/TM–12749) **Phase and group velocities for Lamb waves in DOP-26 iridium alloy sheet.** Simpson, W.A.; McGuire, D.J. Oak Ridge National Lab., TN (United States). Jul 1994. 33p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE94016590. Source: OSTI; NTIS; INIS; GPO Dep.

The relatively coarse grain structure of iridium weldments limits the ultrasonic inspection of these structures to frequencies in the low megahertz range. As the material thickness is nominally 0.635 mm for clad vent set capsules, the low frequencies involved necessarily entail the generation of Lamb waves m the specimen. These waves are, of course, dispersive and detailed knowledge of both the phase and group velocities is required in order to determine accurately the location of flaws detected using Lamb waves. Purpose of this study is to elucidate the behavior of Lamb waves propagating in the capsule alloy and to quantify the velocities so that accurate flaw location is ensured. We describe a numerical technique for computing the phase velocities of Lamb waves (or of any other type of guided wave) and derive the group velocities from this information. A frequency-domain method is described for measuring group velocity when multiple Lamb modes are present and mutually interfering in the time domain, and experimental confirmation of the group velocity is presented for the capsule material.

0704 Economic, Industrial, and Business Aspects

Refer also to citation(s) 27563

0706 Environmental Aspects

Refer also to citation(s) 28555

27569 (RL-SEP–676-Del.) **Tritium extraction facility study - 1965.** Kesel, G.P.; Wodrich, D.D. Pacific Northwest Lab., Richland, WA (United States). 20 Aug 1965. 32p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE94016496. Source: OSTI; NTIS; GPO Dep.

This study was prepared in support of AEC-requested reactor case studies. Two of the cases include local separation and purification of tritium from Hanford irradiated aluminum-lithium alloyed slugs after 1974, at which time, the Savannah River Plant would be shut down. Consideration is given to processing N Reactor rods or "K" Reactor I&E slugs. Quantities of tritium to be produced would be five kilograms per year in one case and seven kilograms per year in the other case. The facility would process tritium only through the purification stage. At this point the material would be shipped offsite for storage, packaging and any future weapon stockpile rework.

08 HYDROGEN

0801 Production

Refer also to citation(s) 27577

0802 Storage, Transport, and Handling

27570 Palladium/kieselguhr composition and method. Mosley, W.C. Jr. To Dept. of Energy. 1992. Filed date 21 Aug 1992. U.S. Patent Application 7-933,152. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035. Order Number DE94016120. Source: OSTI; NTIS; GPO Dep.

Disclosed is a hydrogen-absorbing composition and method for making such a composition. The composition comprises a metal hydride, preferably palladium, deposited onto a porous substrate such as kieselguhr, for use in hydrogen-absorbing processes. The composition is made by immersing a substrate in a concentrated solution containing palladium, such as tetra-amine palladium nitrate. Palladium from the solution is deposited onto the porous substrate, which is preferably in the form of kieselguhr particles. The substrate is then removed from the solution, calcined, and heat treated. This process is repeated until the desired amount of palladium has been deposited onto the substrate.

0805 Health and Safety

27571 (EGG-SSRE–9747) **Improved estimates of separation distances to prevent unacceptable damage to nuclear power plant structures from hydrogen detonation for gaseous hydrogen storage: Technical report.** EG and G Idaho, Inc., Idaho Falls, ID (United States). May 1994. 139p. Sponsored by Nuclear Regulatory Commission, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE94015270. Source: OSTI; NTIS; INIS; GPO Dep.

This report provides new estimates of separation distances for nuclear power plant gaseous hydrogen storage facilities. Unacceptable damage to plant structures from hydrogen detonations will be prevented by having hydrogen storage facilities meet separation distance criteria recommended in this report. The revised standoff distances are based on improved calculations on hydrogen gas cloud detonations and structural analysis of reinforced concrete structures. Also, the results presented in this study do not depend upon equivalencing a hydrogen detonation to an equivalent TNT detonation. The static and stagnation pressures, wave velocity, and the shock wave impulse delivered to wall surfaces were computed for several different size hydrogen explosions. Separation distance equations were developed and were used to compute the minimum separation distance for six different wall cases and for seven detonating volumes (from 1.59 to 79.67 lbm of hydrogen). These improved calculation results were compared to previous calculations. The ratio between the separation distance predicted in this report versus that predicted for hydrogen detonation in previous calculations varies from 0 to approximately 4. Thus, the separation distances results from the previous calculations can be either overconservative or unconservative depending upon the set of hydrogen detonation parameters that are used. Consequently, it is concluded that the hydrogen-to-TNT detonation equivalency utilized in previous calculations should no longer be used.

09 BIOMASS FUELS

Refer also to citation(s) 28537

0909 Processing

27572 (LUTKDH-TKKA–1003-1-98-94) **Ethanol from wood. An experimental study of pretreatment and hydrolysis process simulation.** Galbe, M. Lund Univ. (Sweden). Dept. of Chemical Engineering. Apr 1994. 103p. Order Number DE94783390. Source: OSTI; NTIS.

The conversion of lignocellulosic materials to ethanol consists of several chemical unit operations. In the first part of this thesis the pretreatment of the raw material has been investigated. Various conditions for steam pretreatment have been evaluated. It was found that pre-impregnation with gaseous SO_2 yielded a high recovery of sugars from the hemicellulose fraction, about 62%, found in the filtrate after pretreatment, as well as a high recovery of glucose from the cellulose fraction, 95%, based on the raw material after hydrolysis. A two-stage pretreatment method, operating at two different temperatures, was also evaluated. The recovery of glucose in this case was found to be 85% and the recovery of pentoses about 55%. Treatment with hydrogen peroxide after the pretreatment, resulted in a highly accessible material. This material was completely hydrolysed and yielded a high concentration of sugars after hydrolysis. The glucose yield, however, was only about 80%, based on the original raw material. A study of the hydrolysis stage using various temperatures and concentrations of cellulases showed that a hydrolysis temperature of 40 degrees C was optimal. The most suitable proportions of enzymes were found to be 15% celluclast and 3% novozym (w/w dry matter). Process simulation using Aspen Plus constitutes the second part of this thesis. Various process configuration were investigated with the aim of studying the distribution of hexoses, pentoses, ethanol, and various by-products and inhibitors. The result showed that it is possible to increase the sugar concentrations in the fermentation stages and the ethanol concentration in the distillation unit when recirculation of process streams is employed. The formation of inhibitors is a problem which must be considered in the formulation of kinetic models, since up to 25-fold increase in inhibitors was observed for some process configurations. 103 refs, 63 figs, 5 tabs

27573 (LUTKDH-TKKA–1004-1-45-94) **Ethanol from wood. An experimental study of steam pretreatment, enzymatic hydrolysis and enzyme recovery.** Eklund, R. Lund Univ. (Sweden). Dept. of Chemical Engineering. May 1994. 50p. Order Number DE94783391. Source: OSTI; NTIS.

This thesis deals with pretreatment of the raw material, enzymatic hydrolysis of the cellulose fraction and fermentation of the sugars obtained in the bioconversion of lignocellulosics to fuel ethanol. The success of such a process is dependent on high conversion yields in all process steps, together with efficient use of the enzymes. The steam-pretreatment methods was found to be highly efficient in making lignocellulosic materials accessible to cellulolytic enzymes. Impregnation with sulphur dioxide prior to steam pretreatment at 200 degrees C was found to be the most efficient pretreatment method for willow, with which it was possible to reach 95% of the theoretical glucose yield, after subsequent hydrolysis, and a xylose yield of 62%. A temperature of 40-45 degrees C and an enzyme concentration of about 20 FPU/g cellulose were found to be optimal for the hydrolysis of steam-pretreated willow. Delignification with alkali and peroxide increased the accessibility of the material and increased the maximum glucose concentration obtained in the enzymatic hydrolysis from 62 g/l to 83 g/l. However, the treatment reduced the overall yield of glucose, partly due to end-product inhibition in the hydrolysis. A continuous desorption/readsorption procedure was developed to recover spent cellulases after hydrolysis, with which it was possible to recover 18% of the original cellulases from the hydrolysate and 40% from the solid hydrolysis residue. The conditions for simultaneous saccharification and fermentation using either S. cerevisiae or Z. mobilis were optimised and the results show that 88% of the theoretical ethanol yield could be reached in 72 hours, compared with 120 hours when the hydrolysis and fermentation were performed separately. The nutrient addition could be substantially reduced compared with literature data. 85 refs, 12 figs, 6 tabs

27574 (LUTKDH-TKMB–1020) **Ethanol production from lignocellulosic materials. Fermentation and on-line analysis.** Olsson, L. Lund Univ. (Sweden). Dept. of Applied Microbiology. Apr 1994. 68p. Order Number DE94783400. Source: OSTI; NTIS.

The fermentation performance of bacteria, yeast and fungi was investigated in lignocellulosic hydrolysates with the aim of finding microorganisms which both withstand the inhibitors and that have the ability to ferment pentoses. Firstly, the performance of Saccharomyces cidri, Saccharomyces cerevisiae, Lactobacillus brevis, Lactococcus lactis ssp lactis, Escherichia coli and Zymomonas mobilis was investigated in spent sulphite liquor and enzymatic hydrolysate of steam-pretreated willow. Secondly, the performance of natural and recombinant E. coli, Pichia stipitis, recombinant S. cerevisiae, S. cerevisiae in combination with xylose isomerase and Fusarium oxysporum was investigated in a xylose-rich acid hydrolysate of corn cob. Recombinant E. coli was the best alternative for fermentation of lignocellulosic hydrolysates, giving both high yields and productivities. The main drawback was that detoxification was necessary. The kinetics of the fermentation with recombinant E. coli KO11 was investigated in the condensate of steam-pretreated willow. A cost analysis of the ethanol production from willow was made, which predicted an ethanol production cost of 3.9 SEK/l for the pentose fermentation. The detoxification cost constituted 22% of this cost. The monitoring of three monosaccharides and ethanol in lignocellulosic hydro lysates is described. The monosaccharides were determined using immobilized pyranose oxidase in an on-line amperometric analyser. Immobilization and characterization of pyranose oxidase from Phanerochaete chrysosporium is also described. The ethanol was monitored on-line using a micro dialysis probe as an in situ sampling device. The dialysate components were then separated in a column liquid chromatographic system and the ethanol was selectively detected by an amperometric alcohol bio sensor. The determinations with on-line analysis methods agreed well with off-line methods. 248 refs, 4 figs, 12 tabs

27575 (NEI-DK–1577) **Renovation of the biomass conversion plant at Assendrup Main farm.** Ramboell, Hannemann og Hoejlund A/S, Copenhagen (Denmark). Apr 1994. 23p. (In Danish). Contract ENS-51161-92.0041. Order Number DE94783298. Source: OSTI; NTIS.

The biomass conversion plant located on the main farm at Assendrup was installed during 1979 and dimensioned to 16 cubic meters of cow manure daily. The plant, the renovation processes, previous and following operation and previous and following energy flow are shortly described. The plant is connected to a cogeneration plant with a power capacity of 35 kW and heating efficiency of 105 kW. The renovation was mostly carried out by persons employed on the farm. The biomass conversion plant now operates with a high degree of stable methane production higher than 20 cubic meters per cubic meter pumped-in manure slurry. (AB)

27576 (NEI-DK–1584) **Development of an on-line gas chromatographic measuring system for volatile fatty acids (VFA) determination and automated regulation of biogas reactors with regard to specific VF acids.** Torp, S.; Kiaer Ahring, B.; Jungersen, G.; Ravn, O.; Kjoelstad Poulsen, N. Danmarks Tekniske Hoejskole, Lyngby (Denmark). Inst. for Bioteknologi; Danmarks Tekniske Hoejskole, Lyngby (Denmark). Lab. for Teknisk Hygiejne; Dansk Teknologisk Inst., Taastrup (Denmark). Bioteknik; Danmarks Tekniske Hoejskole, Lyngby (Denmark). Servolaboratoriet; Danmarks Tekniske Hoejskole, Lyngby (Denmark). Inst. for Matematisk Modellering. Feb 1994. 36p. (In Danish). Contract ENS-51161-92.0049. Order Number DE94783313. Source: OSTI; NTIS.

This project is divided into two parts: development of an on-line measuring system to control the acid production in the course of biogas processing, and establishing of a control strategy to stabilize the acid level. The first part is emphasized as a reliable measuring system is the necessary prerequisite for the biogas process control. In principle the measuring system consists of five steps: the sampling by means of a ceramic tubular filter mounted in a filter loop with an eccentric spiral pump, sample preparation by adding formic acid, sample injection into the gas chromatograph, separation and detection of single acids in the chromatograph and data processing by means of a microcomputer. A control strategy based on a cascade proportional, integral and differential control regulator (PID) for stabilization of the acid level in a bioreactor, has been tested by computerized simulation. An adaptive regulator aimed towards improved processing is proposed. (EG)

27577 (TPS–94-4) **Reaction rates and products in catalytic cracking of aromatic model substances.** Alden, H.; Espenaes, B.G. TPS Termiska Processer AB, Nykoeping (Sweden). Mar 1994. 41p. (In Swedish). Order Number DE94783395. Source: OSTI; NTIS.

Cracking of naphthalene over a dolomite catalyst was studied in a laboratory experiment. Residence times were down to 10 msec and experiment runs were up to 24 h with high stability. The conversion of naphthalene is strongly dependent on the gas composition. Experiments were performed in gas mixtures of 15 percent CO_2 and 15 percent water in nitrogen, separately and together, and in a simulated process gas, comparable to that in a gasification plant. The reaction rate was much higher in CO_2 than for other gas mixtures, and lowest for the simulated process gas. Rate constants were determined for the reaction in the catalyst bed. Decomposition takes place before and after the bed too. Condensation products, like binaphthyl, were detected at short residence times. The selectivity for formation of reaction products heavier than naphthalene was, however, less than 1 percent of the decomposed naphthalene. Propane and butane were the only aliphatic hydrocarbons in the interval (C_3-C_6) that were detected. Formation of toluene and benzene was favored by high water content of the gas. The fraction of the decomposed naphthalene that was recovered as toluene varied between 2 and 15 percent, dependent on the water content. 21 refs, 29 figs, 4 tabs

27578 (UCRL-ID–117603) **Hydrogen production by gasification of municipal solid waste.** Rogers, R. III. Lawrence Livermore National Lab., CA (United States). 20 May 1994. 15p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. Order Number DE94016483. Source: OSTI; NTIS; GPO Dep.

As fossil fuel reserves run lower and lower, and as their continued widespread use leads toward numerous environmental problems, the need for clean and sustainable energy alternatives

becomes ever clearer. Hydrogen fuel holds promise as such as energy source, as it burns cleanly and can be extracted from a number of renewable materials such as municipal solid waste (MSW), which can be considered largely renewable because of its high content of paper and biomass-derived products. A computer model is being developed using ASPEN Plus flow sheeting software to simulate a process which produces hydrogen gas from MSW; the model will later be used in studying the economics of this process and is based on an actual Texaco coal gasification plant design. This paper gives an overview of the complete MSW gasification process, and describes in detail the way in which MSW is modeled by the computer as a process material. In addition, details of the gasifier unit model are described; in this unit modified MSW reacts under pressure with oxygen and steam to form a mixture of gases which include hydrogen.

0920 Combustion

27579 (SVF–498) **Conversion to firing pulverized biofuels.** Lindman, E.K. (Stockholm Energi AB (Sweden). Teknik och Miljoe); Ingvarsson, P. Stiftelsen foer Vaermeteknisk Forskning, Stockholm (Sweden). Feb 1994. 130p. (In Swedish). Order Number DE94783401. Source: OSTI; NTIS.

This report is a summary of studies, experimental combustions and operating experience from five energy companies, who have converted or plan to convert from coal powder or oil to pulverized fuels from peat, wood or biomass from agriculture. Kalmar Energi AB converted their moving-grate type hot water boiler, 40 MW from coal to pulverized wood combustion in 1990. In 1984/85 Uppsala Energi AB converted the oil-fired CHP-plant, 513 MW to solid fuels. After a period of three years the coal was replaced by peat. At present one of the three coal-fired CHP-boilers, each rating 100 MW at the Haesselby plant in Stockholm, is being converted. Initially a mixture of pulverized wood and low sulphur oil will be used as fuel. Malmoe Kraftvaerme AB has made some trial combustions as well as investigations of the possibility to convert the coal-fired hot water boiler, 125 MW in Limhamn. Vaesteraas Kraftvaermeverk AB has studied the possibilities to convert two boilers, each rating 140 MW at the coal-fired CHP plant for combustion of a mixture of pulverized coal and bio-fuel. There have been several motives for conversion to pulverized biomass fuels. Because of changed taxation the cost for coal has increased. Use of a domestic renewable fuel decreases the vulnerability at the same times as the contribution to the global warming diminishes limitations of sulphur emissions can be made without costly investments. Emissions of nitrogen oxides have been reduced after conversion from fossil fuels to bio-fuels. Concerning the risks from fire and explosion, it can be noted that conditions are similar for pulverized wood and pulverized peat. Comparing to coal the similarity is large when handling the pulverized fuel, but there is a large difference when it comes to storing the fuels. 32 figs, 13 tabs

0980 Waste Management

27580 (NYSERDA–94-9) **The potential for use of waste-to-energy facility ash: Executive summary: Final report.** Koppelman, L.E. (Long Island Regional Planning Board, Hauppauge, NY (United States)); Tanenbaum, E.G. New York State Energy Research and Development Authority, New York, NY (United States); Long Island Regional Planning Board, Hauppauge, NY (United States). May 1994. 63p. Sponsored by New York State Energy Research and Development Authority, Albany, NY (United States). Source: OSTI; NYSERDA, Two Rockefeller Plaza, Albany, NY 12223 (United States).

This executive summary presents an overview of the investigations, findings, conclusions, and recommendations of the Long Island Regional Planning Board (LIRPB) study of the Potential for Beneficial Use of Waste-to-Energy Facility Ash. The full report consists of the following volumes: Executive Summary; Volume 1: Long Island Ash Management Status; Volume 2: Sampling and Testing Procedures; Volume 3: Environmental Properties; Volume 4: Engineering Properties; Volume 5: Environmental Assessment; Volume 6: Engineering and Economic Evaluation; and Volume 7: Legal and Institutional Issues. Volumes one through seven are briefly summarized in this executive summary with the exception of Volume 2 of the report, which serves as the documentation of the sampling conditions and testing methods used in measuring chemical and physical properties of the ash tested. The study investigated the feasibility of the use of incinerator ash as a substitute for natural aggregate in construction applications.

10 SYNTHETIC FUELS

1002 Production

Refer also to citation(s) 27991, 27992

27581 (ANL/ET/CP–81069) **Dense ceramic membranes for partial oxygenation of methane.** Balachandran, U. (Argonne National Lab., IL (United States). Energy Technology Div.); Dusek, J.T.; Sweeney, S.M.; Mieville, R.L.; Maiya, P.S.; Kleefisch, M.S.; Pei, S.; Kobylinski, T.P.; Bose, A.C. Argonne National Lab., IL (United States). Energy Technology Div. May 1994. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-940713–1: 3. international conference on inorganic membranes, Worcester, MA (United States), 10-14 Jul 1994). Order Number DE94015021. Source: OSTI; NTIS; GPO Dep.

The most significant cost associated with partial oxidation of methane to syngas is that of the oxygen plant. In this paper, the authors offer a technology that is based on dense ceramic membranes and that uses air as the oxidant for methane-conversion reactions, thus eliminating the need for the oxygen plant. Certain ceramic materials exhibit both electronic and ionic conductivities (of particular interest is oxygen-ion conductivity). These materials transport not only oxygen ions (functioning as selective oxygen separators) but also electrons back from the reactor side to the oxygen/reduction interface. No external electrodes are required and if the driving potential of transport is sufficient, the partial oxidation reactions should be spontaneous. Such a system will operate without an externally applied potential. Oxygen is transported across the ceramic material in the form of oxygen anions, not oxygen molecules. In principle, the dense ceramic materials can be shaped into a hollow-tube reactor, with air passed over the outside of the membrane and methane through the inside. The membrane is permeable to oxygen at high temperatures, but not to nitrogen or any other gas. Long tubes of La-Sr-Fe-Co-O (SFC) membrane were fabricated by plastic extrusion, and thermal stability of the tubes was studied as a function of oxygen partial pressure by high-temperature XRD. Mechanical properties were measured and found to be acceptable for a reactor material. Fracture of certain SFC tubes was the consequence of an oxygen gradient that introduced a volumetric lattice difference between the inner and outer walls. However, tubes made with a particular stoichiometry (SFC-2) provided methane conversion efficiencies of >99% in a reactor. Some of the reactor tubes have operated for up to ≈ 1,000 h.

13 HYDRO ENERGY

1304 Legislation and Regulations

27582 (DOE/BP–67(12/91)) **Pacific Northwest electric power planning and conservation act with index.** USDOE Bonneville Power Administration, Portland, OR (United States). Dec 1991. 50p. Sponsored by USDOE, Washington, DC (United States). Order Number DE94015990. Source: OSTI; NTIS; GPO Dep.

The Pacific Northwest Electric Power Planning and Conservation Act was enacted by the Senate and House of Representatives of the United States of America. It was enacted to assist the electrical consumers of the Pacific Northwest through use of the Federal columbia River Power System to achieve cost-effective energy conservation, to encourage the development of renewable energy resources, to establish a representative regional power planning process, to assure the region of an efficient and adequate power supply, and for other purposes. Contents of the Act are: short title and table of contents; purposes; definitions; regional planning and

participation; sale of power; conservation and resource acquisition; rates; amendments to existing law; administrative provisions; savings provisions; effective date; and severability.

27583 (DOE/BP–561(11/92)) **Bonneville Project Act, Federal Columbia River Transmission System Act and other related legislation.** USDOE Bonneville Power Administration, Portland, OR (United States). Nov 1992. 27p. Sponsored by USDOE, Washington, DC (United States). Order Number DE94015989. Source: OSTI; NTIS; GPO Dep.

Legislative texts are provided for: Bonneville Project Act which authorizes the completion, maintenance, and operation of Bonneville project for navigation, and for other purposes; Federal Columbia River Transmission system Act which enables the Secretary of the Interior to provide for operation, maintenance, and continued construction of the Federal transmission system in the Pacific Northwest by use of the revenues of the Federal Columbia River Power System and the proceeds of revenue bonds, and for other purposes; public law 88–552 which guarantees electric consumers of the Pacific Northwest first call on electric energy generated at Federal hydroelectric plants in that regions and reciprocal priority, and for other purposes; and public law 78–329 which provides for the partial construction of the Hungary Horse Dam on the South Fork of the Flathead River in the state of Montana, and for other purposes

1305 Economic, Industrial and Business Aspects

Refer also to citation(s) 27828

1306 Environmental Aspects

27584 (DOE/BP/07084–3) **Development of a systemwide program: Stepwise implementation of a predation index, predator control fisheries, and evaluation plan in the Columbia River Basin: Annual report 1992: Volume 1.** Willis, C.F. (ed.) (S.P. Cramer and Associates, Inc., Milwaukie, OR (United States)); Ward, D.L. (ed.); Nigro, A.A. (ed.). Oregon Dept. of Fish and Wildlife, Portland, OR (United States); Oregon Dept. of Fish and Wildlife, Clackamas, OR (United States); Cramer (S.P.) and Associates, Inc., Milwaukie, OR (United States); Washington State Dept. of Wildlife, Olympia, WA (United States); Columbia River Inter-Tribal Fish Commission, Portland, OR (United States); Washington Univ., Seattle, WA (United States); National Marine Fisheries Service, Seattle, WA (United States); Fish and Wildlife Service, Cook, WA (United States); Pacific StJun 1994. 363p. Sponsored by USDOE, Washington, DC (United States). DOE Contract BI79-90BP07084. Order Number DE94016042. Source: OSTI; NTIS; GPO Dep.

Results of the second year are reported of a basinwide program to harvest northern squawfish in an effort to reduce mortality due to squawfish predation on juvenile salmonids during their migration from natal streams to the ocean. Six papers are included in this report. They are entitled: feasibility investigation of a commercial longline fishery for northern squawfish in the Columbia River downstream from Bonneville dam; evaluation of the northern squawfish sport-reward fishery in the Columbia and Snake Rivers; controlled angling for northern squawfish at selected dams on the Columbia and Snake Rivers in 1992; evaluation of harvest technology for squawfish control in Columbia River reservoirs; effectiveness of predator-removal for protecting juvenile fall chinook salmon released from Bonneville Hatchery; and Northern squawfish sport-reward payments.

27585 (DOE/BP/07084–4) **Development of a systemwide program: Stepwise implementation of a predation index, predator control fisheries, and evaluation plan in the Columbia River Basin: Annual report 1992: Volume 2.** Willis, C.F. (ed.) (S.P. Cramer and Associates, Inc., Milwaukie, OR (United States)); Ward, D.L. (ed.); Nigro, A.A. (ed.). Oregon Dept. of Fish and Wildlife, Portland, OR (United States); Oregon Dept. of Fish and Wildlife, Clackamas, OR (United States); Cramer (S.P.) and Associates, Inc., Milwaukie, OR (United States); Oregon State Univ., Corvallis, OR (United States); Oregon State Univ., Astoria, OR (United States). Seafoods Lab.; Oregon State Dept. of Environmental Quality, Portland, OR (United States); Computer Sciences Corp., Lanham, MD (United States). Jun 1994. 287p. Sponsored by USDOE, Washington, DC (United States). DOE Contract BI79-90BP07084. Order Number DE94016041. Source: OSTI; NTIS; GPO Dep.

The authors report their results of studies to determine the extent to which northern squawfish predation on juvenile salmonids is a problem in the Columbia River Basin, and to evaluate how effectively fisheries can be used to control northern squawfish populations and reduce juvenile salmonid losses to predation. These studies were initiated as part of a basinwide program to control northern squawfish predation and reduce mortality of juvenile salmonids on their migration to the ocean. Three papers are included in this report. They are entitled: (1) Development of a Systemwide Predator Control Program: Indexing and Fisheries Evaluation; (2) Economic, Social and Legal Feasibility of Commercial Sport, and Bounty Fisheries on Northern Squawfish; (3) Columbia River Ecosystem Model (CREM): Modeling Approach for Evaluation of Control of Northern Squawfish Populations using Fisheries Exploitation.

27586 (DOE/BP/10891–1) **Survival estimates for the passage of juvenile chinook salmon through Snake River dams and reservoirs: Annual report 1993.** Iwamoto, R.N. (National Marine Fisheries Service, Seattle, WA (United States). Coastal Zone and Estuarine Studies Div.); Muir, W.D.; Sandford, B.P.; McIntyre, K.W.; Frost, D.A.; Williams, J.G.; Smith, S.G.; Skalski, J.R. National Marine Fisheries Service, Seattle, WA (United States). Coastal Zone and Estuarine Studies Div.; Washington Univ., Seattle, WA (United States). Center for Quantitative Science. Apr 1994. 140p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AI79-93BP10891. Order Number DE94016767. Source: OSTI; NTIS; INIS; GPO Dep.

A pilot study was conducted to estimate survival of hatchery-reared yearling chinook salmon through dams and reservoirs on the Snake River. The goals of the study were to: (1) field test and evaluate the Single-Release, Modified-Single-Release, and Paired-Release Models for the estimation of survival probabilities through sections of a river and hydroelectric projects; (2) identify operational and logistical constraints to the execution of these models; and (3) determine the usefulness of the models in providing estimates of survival probabilities. Field testing indicated that the numbers of hatchery-reared yearling chinook salmon needed for accurate survival estimates could be collected at different areas with available gear and methods. For the primary evaluation, seven replicates of 830 to 1,442 hatchery-reared yearling chinook salmon were purse-seined from Lower Granite Reservoir, PIT tagged, and released near Nisqually John boat landing (River Kilometer 726). Secondary releases of PIT-tagged smolts were made at Lower Granite Dam to estimate survival of fish passing through turbines and after detection in the bypass system. Similar secondary releases were made at Little Goose Dam, but with additional releases through the spillway. Based on the success of the 1993 pilot study, the authors believe that the Single-Release and Paired-Release Models will provide accurate estimates of juvenile salmonid passage survival for individual river sections, reservoirs, and hydroelectric projects in the Columbia and Snake Rivers.

27587 (DOE/BP/13084–6) **Pen rearing and imprinting of fall chinook salmon: Final report.** Beeman, J.W.; Novotny, J.F. National Biological Survey, Cook, WA (United States). Columbia River Research Lab. Jun 1994. 27p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AI79-83BP13084. Order Number DE94015991. Source: OSTI; NTIS; GPO Dep.

Results of rearing upriver bright fall chinook salmon juveniles in net pens and a barrier net enclosure in two backwater areas and a pond along the Columbia River were compared with traditional hatchery method. Growth, smoltification, and general condition of pen-reared fish receiving supplemental feeding were better than those of fish reared using traditional methods. Juvenile fish receiving no supplemental feeding were generally in poor condition resulting in a net loss of production. Rearing costs using pens were generally lower than in the hatchery. However, low adult returns,resulted in greater cost per adult recovery than fish reared

and released using traditional methods. Much of the differences in recovery rates may have been due to differences in rearing locations, as study sites were as much as 128 mi upstream from the hatcheries and study fish may have incurred higher mortality associated with downstream migration than control fish. Fish reared using these methods could be a cost-effective method of enhancing salmon production in the Columbia River Basin.

27588 (DOE/BP/60559–1) **Hungry Horse mitigation: Aquatic modeling of the selective withdrawal system – Hungry Horse Dam, Montana.** Marotz, B.L. (Montana Dept. of Fish, Wildlife and Parks, Kalispell, MT (United States)); Althen, C.; Gustafson, D. Montana Dept. of Fish, Wildlife and Parks, Kalispell, MT (United States); Montana State Univ., Bozeman, MT (United States). Dept. of Biology. Apr 1994. 29p. Sponsored by USDOE, Washington, DC (United States). DOE Contract BI79-92BP60559. Order Number DE94016387. Source: OSTI; NTIS; INIS; GPO Dep.

Hungry Horse Dam presently releases frigid water from the bottom of the reservoir all year long. Cold water effects insect production and fish growth downstream. Rapid temperature changes of up to 8.3 C (14 F) have been measured in the Flathead River downstream of the South Fork confluence, controlled by dam discharges. Thermal effects from Hungry Horse Dam are detectable for over 64 Km downstream to Flathead Lake. The installation of a selective withdrawal structure on each of the dam's discharge penstocks was determined to be the most cost-effective means to provide constant, permanent temperature control without impacting power production and flexibility in dam operation. The thermal model presented herein revealed that fish growth potential in the river would increase two to five times through selective withdrawal, temperature control. Temperature control is possible over the entire range of turbine discharge capacity, with very little effect on power production. Findings indicate that angling would improve through higher catch rates and larger fish. Temperature control will solve the most serious impact to river health. However, flow fluctuations will continue to effect insect production and usable fishery habitat in the Flathead River. A natural thermal regime combined with moderated flow fluctuation would further enhance riverine food production, trout growth and recreation potential.

27589 (DOE/BP/80397–1) **Recovery planning for endangered salmon: A multiple attribute analysis: Final report.** Paulsen, C.M.; Wernstedt, K.; Hyman, J.B. Resources for the Future, Inc., Washington, DC (United States). 9 Dec 1993. 108p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC79-89BP80397. Order Number DE94015999. Source: OSTI; NTIS; GPO Dep.

This analysis addresses multiple dimensions or attributes of recovery planning for endangered Snake River chinook stocks. The authors present a range of biological, economic, and social attributes for a number of recovery actions, and discuss aspects of the recovery actions that relate to each attribute. The emphasis on multiple attributes rather than on narrower biological measures alone reflects their belief that biological issues are only one of several sets of concerns that warrant attention in developing a recovery plan. Furthermore, the authors focus on both qualitative and quantitative factors because a lack of numerical information on certain attributes and recovery actions does not justify ignoring the non-numerical attributes or actions. After introducing the approach and providing the background, they define the attributes. An overview is provided of the biological modeling embedded in the analysis. The model used, the Stochastic Life Cycle Model (SLCM), determines the survival changes (relative to a base case) necessary to meet several biological criteria. These criteria reflect both the likelihood of population extinction and the projected population abundance 100 years into the future, relative to the initial abundance. The recovery options are outlined. The passage and harvest actions are characterized across the attributes is provided. The report assesses the life-stage survival improvements deemed necessary to avoid extinction and comments on the likelihood of meeting these improvements with the proposed actions. A cost-effectiveness analysis of the recovery strategies is provided.

27590 (DOE/BP/93497–T1) **Kootenai river white sturgeon investigations: Annual report, 1993.** Marcuson, P. Idaho Dept. of Fish and Game, Boise, ID (United States). May 1994. 67p. Sponsored by USDOE, Washington, DC (United States). DOE Contract BI79-88BP93497. Order Number DE94013191. Source: OSTI; NTIS; GPO Dep.

US Army Corps of Engineers in concordance with Bonneville Power Administration provided a release of 324.3 m^3/s of impounded water from Lake Koocanusa, Montana from June 2 to June 16, 1993. Nineteen adult white sturgeon equipped with combinations of radio and sonic transmitters were monitored from mid-April to mid-July 1993. Nine females and one male remained in the Kootenai River near the British Columbia/Idaho border and/or Kootenay Lake, British Columbia. Eight sturgeon with transmitters formed the aggregate of unknown numbers of fish in the staging area. The monitored fish were all judged late vitellogenic and were used to characterize what was assumed reproductive behavior of white sturgeon in the Kootenai River. Four late vitellogenic females upriver with the lowland spring runoff (May 11), lingered around the "staging area" May 11–24, then retreated downriver May 21–24. Two fish retreated all the way to Kootenay Lake, British Columbia; the other two re-advanced upriver May 27–30 concurrent with the initiation of the augmented discharge on May 28. By June 4, the remaining females began moving downriver. Male sturgeon tended to move upriver seven days earlier than the females. They arrived in staging waters about May 11. On May 21, three male sturgeon demonstrated a slight downriver run the same time as did the females. The maximum downriver travel was 14.2 km. All four of the monitored males returned upriver just prior to and during the augmented flow period. The flow test did not produce any known recruitment to the diminishing white sturgeon population.

27591 (PNL-SA–24329) **Riparian vegetation of the Snake River in Washington State.** Phillips, R.C. (Pacific Northwest Lab., Richland, WA (United States)); Mettler, L. Pacific Northwest Lab., Richland, WA (United States). Jun 1994. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. (CONF-9405189–1: Wetlands: local functions, global dependence conference, Portland, OR (United States), 30 May - 2 jun 1994). Order Number DE94014446. Source: OSTI; NTIS; GPO Dep.

In January 1992, the US Army Corps of Engineers selected reservoir drawdown and lowered pool elevation as the preferred alternative in the Columbia River Salmon Flow Measured Options Analysis/Environmental Impact Statement (EIS). During March 1992, reservoirs upstream from Lower Granite and Little Goose Dams on the Snake River were drawn down below the minimum operating pool (MOP), which is 5 vertical feet below ordinary high water level (0@) level. The reservoir upstream from Lower Granite Dam was drawn down to approximately 37 ft below 0 while that upstream of Little Goose Dam was drawn down to approximately 15 ft (4.5 m) below MOP. Following the drawdown (March 1–31, 1992), the reservoirs of all four dams in the Snake River of Washington State (Lower Granite, Little Goose, Lower Monumental, Ice Harbor) were maintained at MOP (April 1–July 31,1992). This allowed a defined portion of shoreline to be exposed for an extended period. The objectives of the study were to monitor impacts to the associated upland, riparian/wetland, and aquatic vegetation and newly exposed shorelines of four reservoirs of the Snake River during the flow measures study; and monitor the newly exposed shorelines for invasion of pioneering species during the entire period of the wildlife monitoring study.

14 SOLAR ENERGY

1401 Resources and Availability

27592 (NREL/TP–463-5607) **Solar radiation data manual for flat-plate and concentrating collectors.** Dunlap, M.A. (ed.); Marion, W.; Wilcox, S. National Renewable Energy Lab., Golden, CO (United States). [1994]. 257p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC36-83CH10093. Order Number DE93018229. Source: OSTI; NTIS; GPO Dep.

For designers and engineers of solar energy-related systems, the Solar Radiation Data Manual for Flat-Plate and Concentrating

Collectors gives the solar resource available for various types of collectors for the US and its territories. The data in the manual were modeled using hourly values of direct beam and diffuse horizontal solar radiation from the National Solar Radiation Data Base (NSRDB). The NSRDB contains modeled (93%) and measured (7%) global horizontal, diffuse horizontal, and direct beam solar radiation for 1961-1990.

1403 Economic, Industrial, and Business Aspects

27593 (DOE/ET/20279–T17) **Photovoltaic systems for export application: Informal report.** Duffy, J. (Univ. of Lowell, MA (United States)); Campbell, H.; Sajo, A.; Sanz, E. Massachusetts Inst. of Tech., Cambridge, MA (United States). 31 Jan 1988. 86p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76ET20279. Order Number DE94015479. Source: OSTI; NTIS; GPO Dep.

One approach to improving the competitiveness of photovoltaic systems is the development of designs specifically for export applications. In other words, where is it appropriate in a system design to incorporate components manufactured and/or assembled in the receiving country in order to improve the photovoltaic exports from the US? What appears to be needed is a systematic method of evaluating the potential for export from the US of PV systems for various application in different countries. Development of such a method was the goal of this project.

27594 (NEI-DK–1580) **Danish participation in the IEA solar cell activities: Report on the first year of participation.** PA Energy A/S, Malling (Denmark). May 1994. 24p. (In Danish, English). Order Number DE94783285. Source: OSTI; NTIS; INIS.

In the 12-month period 01.05.93 - 30.04.94 the Danish activities in the IEA 'Solar Cell Agreement' consisted in: participation in the Executive Committee (ExCo) and participation in Task 1 'Exchange and Dissemination of Information on PV Power Systems'. ExCo has meetings every half-year and is a coordinating organ for the Agreement. Work on the Task 1 is organized in 4 subtasks: (1) mapping of solar cell activities in the OECD countries and preparation of an IEA handbook on solar cell technology; (2) publishing of a semiannual newsletter about the agreement; (3) an 'executive conference' on solar cell technology and its uses with participation of the decision-makers in respective power industries; (4) information dissemination whenever required. Demonstration projects, like a photovoltaic roof-integrated system connected to the grid. have been implemented. Three larger solar cell projects, subsidized by the EU means, comprehend 'real time monitoring' by a solar system, WHO project 'Solar Energy Applications for Primary Health Care Clinics for Remote Rural Areas' (SAPHIR) and a grid-connected photovoltaic system in a suburb residential settlement. (EG)

1405 Solar Energy Conversion

Refer also to citation(s) 27988

27595 (DOE/ER/13387–74) **Vectorial electron transfer in spatially ordered arrays: Progress report, January 1991–January 1994.** Fox, M.A. Texas Univ., Austin, TX (United States). Dept. of Chemistry. Jan 1994. 18p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG05-85ER13387. Order Number DE94016640. Source: OSTI; NTIS; GPO Dep.

Objective was to find methods for rapid, controlled placement of light absorbers, relays, and multi-electron catalysts at defined sites with respect to a semiconductor or metal surface and thus to develop methods for preparing chemically modified photoactive surfaces as artificial photosynthetic units. Progress has been made in four areas: synthesis of new materials for directional electron transfer, preparation and characterization of anisotropic composites containing organic and inorganic components, elaboration of mechanisms of electrocatalysis, and development of new methods for surface modification of metals and semiconductors.

27596 (NREL/CP–413-7033) **Role of point defects/defect complexes in silicon device processing: Book of abstracts, fourth workshop.** National Renewable Energy Lab., Golden, CO (United States). Jun 1994. 96p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC36-83CH10093. (CONF-9406203–Absts.: 4. workshop on role of point defects/defect complexes in silicon device processing, Beaver Creek, CO (United States), 27-29 Jun 1994). Order Number DE94011828. Source: OSTI; NTIS; GPO Dep.

The 41 abstracts are arranged into 6 sessions: impurities and defects in commercial substrates: their sources, effects on material yield, and material quality; impurity gettering in silicon: limits and manufacturability of impurity gettering and in silicon solar cells; impurity/defect passivation; new concepts in silicon growth: improved initial quality and thin films; and silicon solar cell design opportunities.

27597 (NREL/TP–411-6855) **Small-angle x-ray scattering studies of microvoids in amorphous-silicon-based semiconductors: Final subcontract report, 1 February 1991–31 January 1994.** Williamson, D.L. (Colorado School of Mines, Golden, CO (United States)); Jone, S.J.; Chen, Y. National Renewable Energy Lab., Golden, CO (United States); Colorado School of Mines, Golden, CO (United States). Jul 1994. 41p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC36-83CH10093. Order Number DE94011840. Source: OSTI; NTIS; GPO Dep.

This report describes work performed to provide new details of the microstructure for the size scale from about 1 nm to 30 nm in high-quality hydrogenated amorphous-silicon and related alloys prepared by current state-of-the-art deposition methods as well as by new and emerging deposition technologies. The purpose of this work is to help determine the role of microvoids and other density fluctuations in controlling the opto-electronic and photovoltaic properties. The approach involved collaboration with several groups that supplied relevant systematic sets of samples and the associated opto-electronic/photovoltaic data to help address particular issues. The small-angle X-ray scattering (SAXS) technique, as developed during this project, was able to provide microstructural information with a high degree of sensitivity not available from other methods. It is particularly sensitive to microvoids or H-rich microdomains and to the presence of oriented microstructures. The latter is readily associated with columnar-type growth and can even be observed in premature stages not detectable by transmission electron microscopy. Flotation density measurements provided important complementary data. Systematic correlations demonstrated that material with more SAXS-detected microstructure has to-electronic and photovoltaic properties and increased degradation under light soaking. New results related to alloy randomness emerged from our ability to measure the diffuse scattering component of the SAXS.

27598 (NREL/TP–411-6864) **Growth mechanisms and characterization of hydrogenated amorphous-silicon-alloy films: Final subcontract report, 15 February 1991–14 April 1994.** Gallagher, A. (National Inst. of Standards and Technology, Boulder, CO (United States)); Tanenbaum, D.; Laracuente, A.; Kalra, P. National Renewable Energy Lab., Golden, CO (United States); National Inst. of Standards and Technology, Boulder, CO (United States). Jul 1994. 23p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC36-83CH10093. Order Number DE94011842. Source: OSTI; NTIS; GPO Dep.

This report describes work performed to better understand the atomic-scale structure of glow-discharge-produced a-Si:H, a-Ge:H, and a-Si:Ge:H films; its effect on film quality; and its dependence on deposition discharge conditions. Hydrogenated a-Si films are from a silane rf discharge onto atomically flat crystal Si and GaAs substrates. The substrates are then transferred in a scanning tunneling microscope, where the atomic-scale surface morphology is measured. The films were deposited using device-quality deposition conditions; IR absorption, σ_L, and σ_D indicate high-quality intrinsic films. From the thickness dependence of the surface morphology, we determined that the films initially conform smoothly to an atomically flat Si or GaAs substrate, but as the thickness increases the roughness steadily increases to approximately 10% of the length of the scanned region. The surface of 100–400-nm-thick films is highly inhomogeneous, with steep hills and canyons in some areas and large atomically smooth regions in others. These unexpectedly large surface irregularities indicate severe and often connected void structures in the growing film, as well as relatively

limited-range surface diffusion of the incorporating SiH_3 radicals. On the other hand, large atomically flat surface were occasionally found, indicating the possibility of growing a homogeneous and compact amorphous film if appropriate growth conditions could be discovered.

27599 (NREL/TP–413-6853) **Development of large-area monolithically integrated Silicon-Film™ photovoltaic modules: Annual subcontract report, 1 January 1993–31 December 1993.** Rand, J.A. (AstroPower, Inc., Newark, DE (United States)); Cotter, J.E.; Ingram, A.E.; Ruffins, T.R.; Thomas, C.J.; Hall, R.B.; Barnett, A.M. National Renewable Energy Lab., Golden, CO (United States); AstroPower, Inc., Newark, DE (United States). Jun 1994. 19p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC36-83CH10093. Order Number DE94011830. Source: OSTI; NTIS; GPO Dep.

This report describes work performed under a program to develop Silicon-Film™ Product III into a low-cost, stable solar cell for large-scale terrestrial power applications. The Product III structure is a thin polycrystalline layer of silicon on a durable, insulating, ceramic) substrate. The insulating substrate allows the silicon layer to be isolated and metallized to form a monolithically interconnected array of solar cells. High efficiency is achievable with the use of light trapping and a passivated back surface. The long-term goal for the product is a 1200-cm^{-2}, 18%-efficient solar module. This report discusses material quality improvements due to the use of new metallurgical barrier technologies. The barrier is essential in preventing impurity interaction between the silicon film and the low-cost substate. Also, a new filament-based fabric substate material was investigated. Efficiencies greater than 10% were achieved on 1.0-cm^2 devices made on these substrates. We also demonstrated the monolithic fabrication sequence by the fabrication of a prototype array using the device processing sequences developed during Phase 11 of this program.

27600 (NREL/TP–451-6491) **Recombination and metastability in amorphous silicon and silicon-germanium alloys: Final subcontract report, 1 February 1991–31 January 1994.** Silver, M. (North Carolina Univ., Chapel Hill, NC (United States)); Han, D.X.; Wang, K.D.; Kemp, M. National Renewable Energy Lab., Golden, CO (United States); North Carolina Univ., Chapel Hill, NC (United States). Jul 1994. 35p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC36-83CH10093. Order Number DE94011837. Source: OSTI; NTIS; GPO Dep.

Electroluminescence-spectra- and transient-current measurements were taken before and after light-soaking a-Si:H p-i-n structures. For the first time, we were able to distinguish between bulk- and junction-controlled recombination. We found that in buffered p-b-i-n structures, the main-band luminescence was more pronounced than that in simple p-i-n structures. The enhancement of the main-band luminescence relates with an increase of the open-circuit voltage. This is evidence that the recombination takes place near the p-i interface, and the quality of the p-i interface is very important in solar cell performance. We also found that for thick p-i-n cells ($\geq$2 μm), the luminescence contains more high-energy photons (1.1–1.2 eV) than does that for thin cells. Furthermore, the high-energy recombination is more efficient in creating metastable defects than is the low-energy recombination. Consequently, the thinner the i-layer, the less the light-induced effects. The results of repetition rate and reverse bias effects on forward-bias current imply that the junctions recover faster than the bulk when subjected to excess carriers caused by the bias. By including the coulomb interaction, we made progress on a microscopic model for radiative recombination.

27601 (NREL/TP–451-6862) **Alternative fabrication techniques for high-efficiency $CuInSe_2$ and $CuInSe_2$-alloy films and cells: Final subcontract report, 1 March 1990–31 August 1992.** Rockett, A. (Illinois Univ., Urbana, IL (United States)); Yang, L.C.; Kenshole, G.; Banda, E.; Feen, A. National Renewable Energy Lab., Golden, CO (United States); Illinois Univ., Urbana, IL (United States). Jul 1994. 25p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC36-83CH10093. Order Number DE94011846. Source: OSTI; NTIS; GPO Dep.

Work performed during the course of this subcontract has led to improved $CuInSe_2$ (CIS) processing techniques and materials resulting in improved solar cell performance (up to 10% active area efficiency) based on a thick conductive evaporated CdS window layer and an indium-tin-oxide transparent conductor. Modeling of the device performance has indicated that an optimal CdS thickness should exist if pinholes occur in the CIS layer (for example, due to adhesion failures) leading to shunts between the CdS and the back contact. Pinholes in the CIS layer have been dramatically reduced by the use of a Cu-Mo two-phase back contact metallization resulting from significant increases in adhesion between the CIS and the back contact. Controlled leaching of the Cu from the back contact apparently contributes to this improvement without degradation of the solar cells. Finally, CIS has been grown epitaxially on GaAs. Preliminary results suggest explanations for the morphology and defect structures of polycrystalline layers used in devices as well as indicating the general mechanism for growth of CIS by vapor phase methods.

27602 (NREL/TP–451-7045) **In-situ characterization of growth and interfaces in a-Si:H devices: Final subcontract report, 1 May 1991–31 May 1994.** Collins, R.W. (Pennsylvania State Univ., University Park, PA (United States)); Wronski, C.R.; An, I.; Lu, Y.; Nguyen, H.V. National Renewable Energy Lab., Golden, CO (United States); Pennsylvania State Univ., University Park, PA (United States). Jul 1994. 100p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC36-83CH10093. Order Number DE94011847. Source: OSTI; NTIS; GPO Dep.

This report describes work to identify materials parameters that can quantitatively describe the solar cell performance correctly in the initial and stabilized states and are consistent with a microscopic model of the metastable defect site. The objective is to be accomplished by applying results of in-situ analyses of a-Si:H surfaces and the transparent conducting oxide (TCO)/p/i interfaces to complement the present understanding of the electronic properties of materials and devices. A second objective of the program is to demonstrate, characterize, and understand improved doped and undoped "wide-gap" materials for use in achieving 15% stabilized photovoltaic modules ("wide-gap" materials are defined as those materials with a band gap of at least 1.9 eV).

27603 (NREL/TP–451-7047) **Role of polycrystallinity in CdTe and $CuInSe_2$ photovoltaic cells: Final subcontract report, 1 April 1990–30 November 1993.** Sites, J.R. (Colorado State Univ., Fort Collins, CO (United States)). National Renewable Energy Lab., Golden, CO (United States); Colorado State Univ., Fort Collins, CO (United States). Jul 1994. 58p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC36-83CH10093. Order Number DE94011849. Source: OSTI; NTIS; GPO Dep.

The report describes the exploration of several aspects of the role of polycrystallinity in the operation of CdTe, $CuInSe_2$, and $Cu(In,Ga)Se_2$ solar cells. The work included the refinement of several analytical techniques, the documentation and understanding of time-dependent voltage effects, the analysis of a large number of individual cells, and significant progress toward developing a viable current-voltage model. This work was integral to the doctoral training of four students and was greatly assisted by several active collaborations within the polycrystalline thin-film solar cell community.

1406 Photovoltaic Power Systems

Refer also to citation(s) 27593, 27797

27604 (DOE/ET/20279–T16) **Residential solar photovoltaic systems: Final report for the Northeast Residential Experiment Station.** Kern, E.C. Jr. Massachusetts Inst. of Tech., Cambridge, MA (United States). Jun 1986. 86p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76ET20279. Order Number DE94015478. Source: OSTI; NTIS; GPO Dep.

This report covers research and development work conducted by the MIT Energy Lab. from July 1982 through June 1986. This Energy Lab. work in the field of solar photovoltaic systems followed six years of similar work at the MIT Lincoln Lab. under the same contract with the US DOE. The final report from the Lincoln Lab.

period was published by Lincoln Lab. in 1983. During the period of Energy Lab. involvement, the project focused on the refinement of residential scale, roof-mounted photovoltaic systems for application in the northeastern US. Concurrent with the conclusion of MIT's involvement, the New England Electric Co. is building a major field test of residential photovoltaics in Gardner, Massachusetts to determine experimentally the effects of photovoltaics on electric power company operations. Using systems designs and technology developed at MIT, the long-term performance of these thirty residential systems in Gardner will provide a measure of our success.

27605 (DOE/FTR–94008610) **Travel to Guatemala to discuss plans to incorporate renewable energy technologies into rural electrification and water pumping programs: Foreign trip report, February 7–20, 1994.** Harcourt, M.M. II. Sandia National Labs., Albuquerque, NM (United States). 16 Mar 1994. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. Order Number DE94008610. Source: OSTI; NTIS (US Sales Only); GPO Dep.

Travel to Guatemala to discuss plans to incorporate renewable energy technologies into rural electrification and water pumping programs and the Sandia/DOE renewable energy market development activities in Central America. At the Universidad del Valle de Guatemala (UVG), to conduct a Battery/Charge Controller workshop for university, utility, and government engineers and technicians and solar distributors and battery manufacturers from Guatemala, Honduras and Costa Rica. In Honduras, to meet with representatives of the Association for the Development of the Bay Islands (APRODIB) on Roatan Island and conduct evaluations of three photovoltaic-powered water pumping systems to assist Siemens Solar Industries (SSI) in field studies of PV module degradation.

27606 (DOE/FTR–94009143) **A preproposal briefing for the Joint US/Brazilian Rural Electrification Pilot Project: Foreign trip report, January 31–February 8, 1994.** Taylor, R.; Foster, J.; Smith, B. National Renewable Energy Lab., Golden, CO (United States). 24 Mar 1994. 52p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC36-83CH10093. Order Number DE94009143. Source: OSTI; NTIS (US Sales Only); GPO Dep.

A preproposal meeting was held at CEPEL to answer questions regarding the Phase 2 procurement. A meeting with all the Brazilian utility representatives was held on February 2 to review state projects and the answers to questions submitted in writing prior to the preproposal meeting. The preproposal meeting itself was held on February 3, attended by representatives from seven US suppliers, the Brazilian utilities, CEPEL, and a variety of Brazilian industry interests (most of whom were teamed up with US firms). On February 4, NREL and CEPEL attended a meeting with at the environmental ministry in Fortaleza regarding the issues surrounding the Jericoacoara hybrid power site. The result of the meeting was that a conventional utility line extension would likely be brought into the village, so the PV-wind-hybrid opportunity would be lost. Given this information, project personnel have identified an alternative site. On February 5 and 6, a site visit was made to small villages surrounding the town of Afogados da Ingazeira in central Pernambuco were the equipment from the Phase I activity is being installed. On February 7 a brief meeting was held with CHESF (the main hydro electric power producer in the Northeast region of Brazil) who had participated in the Jericoacoara evaluation.

27607 (NEI-DK–1580, [pp. 6]) **Danish status review of PV power applications: IEA implementing agreement on PV power systems, Task 1.** PA Energy A/S, Malling (Denmark). May 1994. 24p. In *Danish participation in the IEA solar cell activities: Report on the first year of participation.* Order Number DE94783285. Source: OSTI; NTIS.

Photovoltaics (PV) have only recently been included in the sphere of activities of the Energy Agency (EA), Ministry of Energy. In 1992 the EA commissioned a study on the status of the PV technology and its potential for Denmark and this study resulted inter alia in the first Danish action plan on PV and in the establishment of a PV advisory group to the EA. Universities, institutions and private sector companies, however, have been active in the field of PV's since the early 1980's, and a Danish PV resource base can be identified to day. In preparation of standard government subsidies to grid-connected PV installations - expected to materialize within 3-5 years - the establishment of a Danish PV system testing and approval facility is now being investigated. Building integrated applications are expected to be the first major break-through in Denmark for PVs; about 50% of the annual generation of a PV module in Denmark originates from diffuse light giving wide limits as to orientation of an array and making a sizeable part of new and existing building surfaces suitable for PV cladding. The Danish utility sector has just started showing an interest in the PV technology, and this interest is expected to grow considerably within the next few years. The most viable short-term prospect of using PV technology in Denmark seem to be in the form of roof/facade integrated, grid-connected systems on residential and commercial buildings. Investigation of a public test / approval facility for PV technology is currently going on. A methodology for lifecycle-analysis of energy systems developed at Roskilde University, Denmark, has been applied to photovoltaic systems, in a collaborative effort between Roskilde University and the University of New South Wales, Australia. (EG)

27608 (SAND–94-1492C) **Photovoltaic power conditioners: Development, evolution, and the next generation.** Bulawka, A. (USDOE, Washington, DC (United States)); Krauthamer, S.; Das, R.; Bower, W. Sandia National Labs., Albuquerque, NM (United States). [1994]. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. (CONF-940812–16: 29. intersociety energy conversion engineering conference, Monterey, CA (United States), 7-12 Aug 1994). Order Number DE94015284. Source: OSTI; NTIS; GPO Dep.

Market-place acceptance of utility-connected photovoltaic (PV) power generation systems and their accelerated installation into residential and commercial applications are heavily dependent upon the ability of their power conditioning subsystems (PCS) to meet high reliability, low cost, and high performance goals. Many PCS development efforts have taken place over the last 15 years, and those efforts have resulted in substantial PCS hardware improvements. These improvements, however, have generally fallen short of meeting many reliability, cost and performance goals. Continuously evolving semiconductor technology developments, coupled with expanded market opportunities for power processing, offer a significant promise of improving PCS reliability, cost and performance, as they are integrated into future PCS designs. This paper revisits past and present development efforts in PCS design, identifies the evolutionary improvements and describes the new opportunities for PCS designs. The new opportunities are arising from the increased availability and capability of semiconductor switching components, smart power devices, and power integrated circuits (PICS).

1407 Solar Thermal Power Systems

27609 (SAND–93-4053) **Solar Electric Generating System II finite element analysis.** Dohner, J.L.; Anderson, J.R. Sandia National Labs., Albuquerque, NM (United States). Apr 1994. 48p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. Order Number DE94015598. Source: OSTI; NTIS; GPO Dep.

On June 2, 1992, Landers' earthquake struck the Solar Electric Generating System II, located in Daggett, California. The 30 megawatt power station, operated by the Daggett Leasing Corporation (DLC), suffered substantial damage due to structural failures in the solar farm. These failures consisted of the separation of sliding joints supporting a distribution of parabolic glass mirrors. At separation, the mirrors fell to the ground and broke. It was the desire of the DLC and the Solar Thermal Design Assistance Center (STDAC) of Sandia National Laboratories (SNL) and to redesign these joints so that, in the event of future quakes, costly breakage will be avoided. To accomplish this task, drawings of collector components were developed by the STDAC, from which a detailed finite element computer model of a solar collector was produced. This nonlinear dynamic model, which consisted of over 8,560 degrees of freedom, underwent model reduction to form a low order nonlinear dynamic model containing only 40 degrees of freedom.

This model was then used as a design tool to estimate joint dynamics. Using this design tool, joint configurations were modified, and an acceptable joint redesign determined. The results of this analysis showed that the implementation of metal stops welded to support shafts for the purpose of preventing joint separation is a suitable joint redesign. Moreover, it was found that, for quakes of Landers' magnitude, mirror breakage due to enhanced vibration in the trough assembly is unlikely.

27610 (SAND–94-0007) **Monitoring solar-thermal systems: An outline of methods and procedures.** Rosenthal, A. (New Mexico State Univ., Las Cruces, NM (United States). Southwest Technology Development Inst.). Sandia National Labs., Albuquerque, NM (United States). Apr 1994. 44p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. Order Number DE94015599. Source: OSTI; NTIS; GPO Dep.

This manual discusses the technical issues associated with monitoring solar-thermal systems. It discusses some successful monitoring programs that have been implemented in the past. It gives the rationale for selecting a program of monitoring and gives guidelines for the design of new programs. In this report, solar thermal monitoring systems are classified into three levels. For each level, the report discusses the kinds of information obtained by monitoring, the effort needed to support the monitoring program, the hardware required, and the costs involved. Ultimately, all monitoring programs share one common requirement: the collection of accurate data that characterize some aspect or aspects of the system under study. This report addresses most of the issues involved with monitoring solar thermal systems. It does not address such topics as design fundamentals of thermal systems or the relative merits of the many different technologies employed for collection of solar energy.

1409 Solar Thermal Utilization

27611 (DTH-LV–92-39) **Solar-wall house with an integrated heating system: Design and construction.** Bruun Joergensen, O.; Svendsen, S.Aa. Danmarks Tekniske Hoejskole, Lyngby (Denmark). Lab. for Varmeisolering. Dec 1992. 35p. (In Danish). Contract ENS-1213/91-0001; Contract ENS-1213/92-0001. Order Number DE94783309. Source: OSTI; NTIS.

EFP-91; EFP-92.

The purpose of this project is to design and construct a solar-wall house with an integrated heating system, able to become a self-sufficient unit with regard to its heat requirements. The house has an air-aperture inside to provide hot air circulation as a substitute for radiators. Solar heat storage is located in the floor construction, in a rock bed facility. The experimental house of such design with an area of about 36 m^2 is now under construction at the Thermal Insulation Laboratory. At present the solar walls are constructed with a double glazing (hardened glass), but in future experiments a more insulating transparent layer will be tested. (EG)

27612 (DTH-LV–93-2) **Heat storage facilities with circulation pipes: Testing of Aidt Miljoes' heat storage facility.** Furbo, S. Danmarks Tekniske Hoejskole, Lyngby (Denmark). Lab. for Varmeisolering. Jan 1993. 25p. (In Danish). Contract ENS-51181-93.0052. Order Number DE94783293. Source: OSTI; NTIS.

The Danish-produced heat storage facility related to solar heating systems was tested in order to determine how water from circulation pipes can be returned to a hot water container in such a way as to cause the least possible mixing in the container. In this covered container the hot water is lead to the circulation pipes from the top of the container through a tapping pipe running out through the bottom of container. The water from the circulation pipe is returned to the container through a branched inlet pipe which stretches from the container's base to its top. The extent of mixing within the container was determined under varying operational conditions. Other tests were carried out where the hot water was inlet to the circulation pipe directly from the top of the container. It was found that the advantageous temperature stratification is broken down when the circulation pipe is utilized. The greater the fluid volume within the circulation pipe the faster the differences in temperature are leveled out. Tests also showed that the heat storage facility's temperature stratification can best be retained if the hot water is added to the circulation pipe from the top of the tank. It is recommended not to use standard water tapping pipes in solar heating systems with circulation piping. (AB)

27613 (DTH-LV–93-10) **Heat storage facilities with circulation pipe: Testing of Djurs Solvarme's heat storage facilities.** Furbo, S. Danmarks Tekniske Hoejskole, Lyngby (Denmark). Lab. for Varmeisolering. Mar 1993. 17p. (In Danish). Contract ENS-51181-92.0052. Order Number DE94783294. Source: OSTI; NTIS.

An examination of the way in which water from a circulation pipe is lead back to the hot water container in a solar heating system's heat storage facility, at the same time causing the least possible agitation in the container, is described in relation to a product from a Danish firm. In the case of this standard product the hot water is lead to the circulation pipe from the top of the container through a drawing-off pipe which runs through the base of the container. The water from the circulation pipe is lead back to the top of the container. An automatic regulating valve is embodied in the heat storage facility's return pipe from the circulation piping. The flow volume in the the circulation piping is thus regulated so that the return temperature is held at the desired level. (AB)

27614 (DTH-LV–94-06) **Calculated capacity of solar heating system with heat storage facility where the backup energy system is time controlled.** Furbo, S. Danmarks Tekniske Hoejskole, Lyngby (Denmark). Lab. for Varmeisolering. Feb 1994. 7p. (In Danish). Contract ENS-51181-92.0052. Order Number DE94783296. Source: OSTI; NTIS.

The calculation of the capacity of a traditional solar heating system with a hot water container which has a built-in heat exchanger spiral and a low flow solar heating system utilizing an enclosed container for heat storages is described. The upper parts of the heat storage systems were heated up by a backup energy system. The capacity was reckoned on the basis of time control, and without time control, of the backup energy system. The results of the measurements are presented and show that it is possible to increase the capacity of small solar water heating systems, if a time-controlled backup energy system is used to heat the upper parts of the solar heating system's heat storage facility. The increase will be to the extent of of 4% - 6% if the hot water is only tapped in the evening and in the morning but if it is also used in the middle of the day the increase in capacity will be 1% - 2%. (AB)

1410 Solar Collectors and Concentrators

Refer also to citation(s) 27813

27615 (DTH-LV–93-31) **Assistance for manufactureres of solar collectors: Partial activities ventilation and self-circulation.** Holck, O. Danmarks Tekniske Hoejskole, Lyngby (Denmark). Lab. for Varmeisolering. Nov 1993. 23p. (In Danish). Contract ENS-51181-92.0052. Order Number DE94783295. Source: OSTI; NTIS.

The experimental investigations on the improvement of ventilation methods for solar collector circuits, and on how to prevent unwished for self circulation in the solar heating system's tube network, are described. Some possible solutions to these problems are given. A component was tested on a simulated solar collector circuit and found to be satisfactory. Calculations were carried out in relation to pressure and water vapor conditions and compared with test results. It was then examined whether the component could be effectively used as a substitute for the traditional expansion tank. (AB)

27616 (LA-UR–94-2080) **Hypersonic gas-surface energy accommodation test facility.** Cross, J.B.; Hoffbauer, M.A.; Cook, S.R. Los Alamos National Lab., NM (United States). [1994]. 20p. Sponsored by Department of Defense, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-940625–7: 6. AIAA/ASME thermophysics and heat transfer conference, Colorado Springs, CO (United States), 20-23 Jun 1994). Order Number DE94014468. Source: OSTI; NTIS; GPO Dep.

A test facility is described that determines energy and momentum accommodation coefficients by direct measurement. Momentum accommodation coefficients are obtained by measuring

the force exerted on surfaces by molecular beams using a torsion balance. Energy accommodation coefficients are obtained through the measurement of angular and velocity distributions of the molecules reflected off the scattering surface. Data obtained from the recoil angular and velocity distribution measurements are also used to calculate momentum accommodation coefficients which are then compared to the results obtained from the torsion balance. Results from a torsion balance measurement of 1.5 km/sec N_2 scattered from solar cell cover plate material are shown.

15 GEOTHERMAL ENERGY

1501 Resources and Availability

27617 (DOE/FTR–94009139) **Travel to Japan to attend and present a paper at "Workshop on Deep-Seated and Magma-Ambient Geothermal Systems": Foreign trip report, March 6–17, 1994.** Lysne, P. Sandia National Labs., Albuquerque, NM (United States). 25 Mar 1994. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. Order Number DE94009139. Source: OSTI; NTIS (US Sales Only); GPO Dep.

Currently Japan is generating 270 MWe from geothermal resources, and another 280 MWe are in the planning stage. However, the Japanese goal of obtaining a 1,000 MWe capacity by the end of the century is politically difficult because most of the promising geothermal fields are inside of national parks, or in hot-spring areas that are revered by the general population. Therefore, the Japanese wish to develop deeper resources located at present power-generation sites, and ways are being sought to explore and exploit this more difficult environment. Furthermore, the Japanese seek the longer-term development of very hot resources that would be found in the vicinity of magmatic bodies. The Japanese seek international cooperation to further these efforts; the workshop was convened to initiate this thrust.

1503 Geothermal Exploration and Exploration Technology

Refer also to citation(s) 27621

27618 (EGG–1183-5074) **The feasibility of developing a borehole sparker for geothermal wells.** McClung, J.B. EG and G Energy Measurements, Inc., Los Alamos, NM (United States). Los Alamos Operations. Jan 1977. 17p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC08-76NV01183. Order Number DE94015127. Source: OSTI; NTIS; GPO Dep.

A feasibility study was undertaken to determine the practicality of designing a borehole sparker (underwater electric discharge) seismic source for use in an extremely harsh environment (69MPa @ 275°C = 10,000 psi @ 527°F). Important electrical and hydrodynamic parameters of underwater spark discharges, component availability, and past accomplishments of others in the field of borehole-to-borehole sparker surveying are discussed. It is concluded that this instrument could be economically developed.

27619 (NUTEK-GT–94-1) **Status of HDR research with special emphasis on design issues.** Wallroth, T. (Chalmers Univ. of Technology, Gothenburg (Sweden). Dept. of Geology). Swedish National Board for Industrial and Technical Development (NUTEK), Stockholm (Sweden); Chalmers Univ. of Technology, Goeteborg (Sweden). Dept. of Geology. [1994]. 46p. Project NUTEK 656-082. (CTH-HDR-P–93-12). Order Number DE94783405. Source: OSTI; NTIS.

In the early 1970s a major research programme aimed at investigating the viability of HDR geothermal energy was initiated at Los Alamos National Laboratory in New Mexico, USA. Following this initiative widespread HDR research started throughout the world and field programmes at different scale were carried out in France, Germany, Great Britain, Japan and Sweden. Currently, the most active field research is going on in Japan and in the upper Rhine graben in NE France. At the latter site a large research programme which is aimed at constructing a scientific HDR prototype is going on. The HDR research group at Chalmers University participates in this project through fundings from NUTEK. The Swedish field research activities are carried out in Fjaellbacka in the west coast, where a test site was established in 1984 as an in-situ research facility for studying geological, hydrogeological and hydromechanical aspects of HDR reservoir behaviour. The latest large-scale experiment at this site was a 40-day open-loop circulation test carried out in 1989 with the aim of investigating the HDR reservoir performance. Based on the experimental work and the associated analysis and modelling, conclusions particularly concerning the hydromechanical behaviour of the reservoir have been drawn. Although there has been about 20 years of HDR related research by international teams, there is still no commercial development of HDR. However, in view of the current comprehensive programme conducted at different places in Japan, the planning of a second, commercial-scale facility in the USA and the European collaboration project in France, the prospects are promising for a realisation of a large-scale energy producing HDR plant within the next five to ten years. 78 refs, 17 figs, 2 tabs

1508 Geothermal Power Plants

27620 (LA-UR–94-1606) **Hot dry rock: A climate change action opportunity for industry.** Duchane, D.V. Los Alamos National Lab., NM (United States). [1994]. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-9404102–6: 12. geothermal program review: geothermal's role in global climate change - impacts on the Climate Change Action Plan, San Francisco, CA (United States), 25-28 Apr 1994). Order Number DE94014818. Source: OSTI; NTIS; GPO Dep.

Geothermal resources in the form of heat found in rock that is hot but is not in contact with sufficient mobile fluid to transport that heat to the surface are a large, as yet virtually unexploited, source of clean energy. The technology to extract useful amounts of energy from this ubiquitous hot dry rock (HDR) geothermal resource has been under development for more than twenty years. During the last two years, flow testing at the Fenton Hill HDR pilot facility in New Mexico has answered many of the questions about the viability of HDR heat mining. While the most important issue of thermal longevity of the artificial geothermal reservoir that is the heart of an HDR energy system was not fully resolved, the test results provided good reasons to be optimistic that such reservoirs can have long lifetimes. No decline was observed in the temperature of the fluid produced during the relatively short test period and tracer testing indicated that the reservoir may be thermally self sustaining. In addition, water consumption during the circulation test was reduced to very low levels, the production of significant excess energy over that required simply to operate the system was verified, and routine energy production with virtually no emissions to the environment, except waste heat, was demonstrated.

1509 Geothermal Engineering

27621 (DOE/NV/10412–10) **Reservoir engineering studies of the Gladys McCall geopressured-geothermal resource: Final report.** Lea, C.M.; Lee, K.; Miller, M.A. Texas Univ., Austin, TX (United States). Center for Petroleum and Geosystems Engineering. Sep 1993. 41p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FC07-85NV10412. Order Number DE94015521. Source: OSTI; NTIS; GPO Dep.

Transient pressure analysis techniques have been used to evaluate the performance of the Gladys McCall geopressured-geothermal reservoir. A fault-controlled aquifer influx model has also been developed to account for pressure support observed during both reservoir depletion and recovery phases. The Gladys McCall No. 1 well was drilled and completed in the lower Miocene geopressured sandstones under the US Department of energy geopressured-geothermal research program. The well was shut in october 1987 after producing over 27 MMstb of brine and 676 MMscf gas since October 1983. Eight pressure transient tests were conducted in the well. Analysis of transient pressure data provided a quantitative evaluation of reservoir characteristics, including: (a) formation transmissibility and skin, (b) the size and possible shape of the main producing reservoir, (c) characteristics of the pressure

support mechanism. The pressure behavior of 1983 Reservoir Limits Test (RLT) suggested that the Gladys McCall reservoir might have a long narrow shape with the well located off-center. An elongated numerical model developed accordingly was able to reproduce the pressure characteristics show in the test. During both the reservoir production and shut-in periods, pressure buildup tests indicated some degree of external pressure support. Aquifer recharging was believed to be the main source. Based on reservoir material-balance calculations, an aquifer influx model was derived from a conceptual model of water leakage through a partially sealing fault into the reservoir under steady-state conditions. Moreover, a match of the pressure history required that the conductivity of the fault be a function of the pressure difference between the supporting aquifer and the reservoir.

27622 (EGG–1183-5068) **Recommendations for a controlled environment enclosure for instrumentation packages.** McClung, B. EG and G, Inc., Las Vegas, NV (United States). Sep 1976. 42p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC08-76NV01183. Order Number DE94015391. Source: OSTI; NTIS; GPO Dep.

An enclosure to protect instrumentation packages from the severe pressure and temperature environment presented by downhole conditions at the LASL Q-12 Division Fenton Hill Geothermal Research site is specified. Due to a general lack of interest by prospective vendors in handling all phases of the design and fabrication, a pressure vessel housing was designed and specified for their use in establishing the thermal insulation and heat sink requirements. Included are specifications recommended for use in purchasing the pressure vessel material and in specifying the important thermal parameters and size limitations.

1510 Direct Energy Utilization

27623 (NUTEK-GT–94-2) **Geothermal energy recovery from sedimentary rock.** Alm, P.G. (Lund Univ. (Sweden). Dept. of Egineering Geology); Bjelm, L. Swedish National Board for Industrial and Technical Development (NUTEK), Stockholm (Sweden); Lund Univ. (Sweden). Dept. of Engineering Geology. [1994]. 47p. (In Swedish). Project NUTEK 656-090. (LUTVDG-TVTG–3038). Order Number DE94783406. Source: OSTI; NTIS.

Operation experience from the geothermal heat pump assisted district heating plant at Lund in south Sweden is reported. The plant has been in operation since early 1985, at a power level of 47 MW and is producing close to 50 percent of the district heat for the city of Lund. The plant is using four production wells and five injection wells, drilled to a depth of about 600 m. The availability has been 97 percent or higher over the nine years. Data on temperatures, flow et cetera are given in appendices for all wells. A short description is also presented of the possibilities for geothermal heat extraction at Ystad (belonging to the same geologic zone, some 50 km distant from Lund), which are estimated to be as good as for Lund. 30 figs

17 WIND ENERGY

1701 Resources and Availability (Climatology)

Refer also to citation(s) 27627

1704 Economic, Industrial, and Business Aspects

Refer also to citation(s) 27626

27624 (NEI-DK–1585) **Diskette-based database covering standards etc. of relevance to the construction of wind turbines.** Dansk Teknologisk Inst., Taastrup (Denmark). MarkedsService. May 1994. 60p. (In Danish). Contract ENS-51171-92.0024. Order Number DE94783307. Source: OSTI; NTIS; INIS.

The project concerns the development of the database "Diskettebaseret database med vindmoellestandarder" (diskette-based database containing wind turbine standards), which contains information about standards, recommendations and other technical documents of relevance for the design, construction and approval of wind mills. The information in the database covers data from Denmark, UK, Germany, Holland and USA together with data from internationally recognized standards and recommendations. The database is contained on a single PC-diskette, which also contains the purpose-built userfriendly serchsoftware. About 5500 records are included in the database. The last edition of the database was updated January 1994. (au)

27625 (NREL/TP–440-6628) **The National Wind Technology Center.** Thresher, R.W. (National Renewable Energy Lab., Golden, CO (United States)); Hock, S.M.; Loose, R.R.; Cadogon, J.B. National Renewable Energy Lab., Golden, CO (United States). Jul 1994. 13p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC36-83CH10093. (CONF-940548–5: American Wind Energy Association annual conference and exhibition, Minneapolis, MN (United States), 9-13 May 1994). Order Number DE94011853. Source: OSTI; NTIS; GPO Dep.

Wind energy research began at the Rocky Flats test site in 1976 when Rockwell International subcontracted with the Energy Research and Development Administration (ERDA). The Rocky Flats Plant was competitively selected from a number of ERDA facilities primarily because it experienced high instantaneous winds and provided a large, clear land area. By 1977, several small wind turbines were in place. During the facility's peak of operation, in 1979-1980, researchers were testing as many as 23 small wind turbines of various configurations, including commercially available machines and prototype turbines developed under subcontract to Rocky Flats. Facilities also included 8-kW, 40-kW, and 225-kW dynamometers; a variable-speed test bed; a wind/hybrid test facility; a controlled velocity test facility (in Pueblo, Colorado); a modal test facility, and a multimegawatt switchgear facility. The main laboratory building was dedicated in July 1981 and was operated by the Rocky Flats Plant until 1984, when the Solar Energy Research Institute (SERI) and Rocky Flats wind energy programs were merged and transferred to SERI. SERI and now the National Renewable Energy Laboratory (NREL) continued to conduct wind turbine system component tests after 1987, when most program personnel were moved to the Denver WEst Office Park in Golden and site ownership was transferred back to Rocky Flats. The Combined Experiment test bed was installed and began operation in 1988, and the NREL structural test facility began operation in 1990. In 1993, the site's operation was officially transferred to the DOE Golden Field Office that oversees NREL. This move was in anticipation of NREL's renovation and reoccupation of the facility in 1994.

1706 Wind Energy Engineering

Refer also to citation(s) 27605, 27624

27626 (NEI-DK–1579) **LM 24.0 turbine blade: Development of a rotor for a 1 MW windmill. Final report.** Graubau, P. LM Glasfiber A/S, Lunderskov (Denmark). May 1994. 6p. (In Danish). Contract ENS-51171-91.0046. Order Number DE94783297. Source: OSTI; NTIS.

The turbine blade should be designed in such a way that it would be suitable for stall-regulated wind turbines (with a tip spoiler), and pitch regulated ones (with no tip spoiler) without making any changes in the surface form of the blade. It was found possible to design one type of blade which would satisfy both needs. The dimensions of the designs are given in full and details are given on the materials used, rotor configuration, operational limits and preliminary calculated annual energy production for LM 24.0 stall regulation. The Danish firm LM Glasfiber A/S can now supply 24.0 meter turbine blades for wind turbines of 800 - 1200 kW capacity, optimized for both stall and pitch regulated turbines. (AB)

27627 (NREL/TP–441-7044) **Wind-electric ice making for villages in the developing world.** Davis, H. (National Renewable Energy Lab., Golden, CO (United States)); Drouilhet, S.; Flowers, L.; Bergey, M.; Brandemuehl, M. National Renewable Energy Lab., Golden, CO (United States). Jul 1994. 13p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC36-83CH10093. (CONF-940548–6: American Wind Energy Association annual conference and exhibition, Minneapolis, MN (United States), 9-13 May

1994). Order Number DE94011854. Source: OSTI; NTIS; GPO Dep.

For many villages in the developing world, renewable energy sources are the most economical means of providing power. There is a significant need for ice to preserve fish and produce for shipment to market. Since fishing villages are near coastlines with fairly reliable wind resources, wind-powered ice machines would capitalize on a good match between ice demand and energy supply. To date little work has ben done on the use of wind turbines for ice making applications. This paper presents the results of wind-electric ice making research project conducted by the University of Colorado, the National Renewable Energy Laboratory and Bergey Windpower Co. Several potential problems related to intermittent and variable frequency operation were determined prior to testing. Initial tests were conducted using a dynamometer to evaluate the significance of these potential problems under simulated conditions and to define basic performance expectations for ice makers in the 1.2 tons/day size range. Field testing will be completed soon to determine long-term performance of one ice maker.

27628 (NUTEK-VIND–94-1) **Effect of low level jets in wind energy potential in a coastal area.** Kaellstrand, B. (Uppsala Univ. (Sweden). Dept. of Meteorology). Swedish National Board for Industrial and Technical Development (NUTEK), Stockholm (Sweden). [1994]. 54p. Project NUTEK 506-226. Order Number DE94783408. Source: OSTI; NTIS.

To investigate the occurrence of low level jets (LLJs), an extensive measuring programme was carried out during the months March to June 1991 at Utlaengan, which is a small island at the south-eastern coast of Sweden. Wind and temperature was measured on a 25 m high tower and pibal trackings were performed once a day at stochastic hours. The pibal measurements resulted in 52 profiles, corresponding to 62% of the days. 33 (63%) of the pibal profiles showed a more or less distinct LLJ. About 2/3 of the profiles with low level jets fulfilled the examined criteria for an inertial oscillation in space. This indicated that LLJs are indeed a common phenomenon in this area, at least during spring and early summer, and that a large amount of them are caused by an inertial oscillation in space. A simple boundary layer wind model was used together with wind profile data from the tower to calculate the wind speed at heights up to 125 m. A comparison showed that the pibal profiles gave about 1.5 m/s (18%) and 2.9 m/s (34%) higher mean wind speed than the model at 75 m and 125 m, respectively. The reason for this is that the simple model is not capable of generating low level jets, and consequently the difference may be interpreted as the contribution to the wind energy potential caused by the presence of LLJs. As the occurrence of LLJs is likely to be more frequent during spring and early summer than during other seasons, this increase in mean wind speed is probably too large on an annual basis. But still, the LLJ effects the wind speed in a not negligible way. 18 refs, 27 figs, 11 tabs

20 FOSSIL-FUELED POWER PLANTS

2001 Power Plants and Power Generation

Refer also to citation(s) 27578

27629 (DOE/MC/30246–3844) **Advanced Turbine Systems Program conceptual design and product development: Quarterly report, November 1993–January 1994.** Karstensen, K.W. Solar Turbines, Inc., San Diego, CA (United States). Jun 1994. 23p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC21-93MC30246. Order Number DE94012276. Source: OSTI; NTIS; GPO Dep.

This Quarterly Technical Progress Report covers the period November 1, 1993, through January 31, 1994, for Phase 11 of the Advanced Turbine Systems (ATS) Program by Solar Turbines Incorporated under DOE Contract No. DE-AC421-93MC30246. The objective of this program is to provide the conceptual design and product development plan for an industrial gas turbine system to operate at a thermal efficiency of 50 percent ("ATS50") with future improvement to 60 percent ("ATS60"). During the prior quarter Solar's ATS Engine Design Team characterized the intercooled and recuperated (ICR) gas turbine cycle in 1-spool, 2-shaft, and 2-spool 3-shaft arrangements. Fixed and variable geometry free power turbines were compared in both arrangements and sensitivity of all combinations to component performance was determined. Full- and part-load performance were compared over a range of ambient air temperatures. During the quarter just completed, the Team defined four unique and different physical arrangements of the gas turbine components outlined above. These three arrangements were then examined in terms of their ability to support Program goals of thermal efficiency, low emissions, increased reliability, availability and maintainability (RAM), and reduced cost of electrical power production. This work, together with preliminary specification of component cooling needs, suggested that earlier studies of the pressure ratio/firing temperature/thermal efficiency relationship should be re-visited. This accomplished, the effect of total cooling air bleed requirements on thermal efficiency was determined. This will lead to the selection of hot section material capability/cooling air requirements which are able to meet Program goals. As noted in the first quarterly report, where there are apparently conflicting data, later results should take precedence due to the continuing refinement of analytical models.

27630 (DOE/PC/89659–T16-App.-Bk.1) **Demonstration of coal reburning for cyclone boiler NO_x control: Appendix, Book 1.** Babcock and Wilcox Co., Cassville, WI (United States). [1994]. 827p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FC22-90PC89659. Order Number DE94013053. Source: OSTI; NTIS; GPO Dep.

Based on the industry need for a pilot-scale cyclone boiler simulator, Babcock Wilcox (B&W) designed, fabricated, and installed such a facility at its Alliance Research Center (ARC) in 1985. The project involved conversion of an existing pulverized coal-fired facility to be cyclone-firing capable. Additionally, convective section tube banks were installed in the upper furnace in order to simulate a typical boiler convection pass. The small boiler simulator (SBS) is designed to simulate most fireside aspects of full-size utility boilers such as combustion and flue gas emissions characteristics, fireside deposition, etc. Prior to the design of the pilot-scale cyclone boiler simulator, the various cyclone boiler types were reviewed in order to identify the inherent cyclone boiler design characteristics which are applicable to the majority of these boilers. The cyclone boiler characteristics that were reviewed include NO_x emissions, furnace exit gas temperature (FEGT) carbon loss, and total furnace residence time. Previous pilot-scale cyclone-fired furnace experience identified the following concerns: (1) Operability of a small cyclone furnace (e.g., continuous slag tapping capability). (2) The optimum cyclone(s) configuration for the pilot-scale unit. (3) Compatibility of NO_x levels, carbon burnout, cyclone ash carryover to the convection pass, cyclone temperature, furnace residence time, and FEGT.

27631 (DOE/PC/90544–T13) **Healy Clean Coal Project 1993 annual progress report.** Stone and Webster Engineering Corp., Englewood, CO (United States). Jun 1994. 15p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FC22-91PC90544. Order Number DE94016034. Source: OSTI; NTIS; GPO Dep.

The primary objective of the HCCP is to demonstrate a new power plant design integrating an advanced combustor and heat recovery system coupled with both high and low temperature emission control processes. The parties anticipate that, if the demonstration project is successful, the technology will be commercialized in the late 1990s and be capable of (1) achieving significant reductions in the emissions of sulfur dioxide and the oxides of nitrogen from existing facilities, (2) providing for future energy needs in an environmentally acceptable manner. Alaskan bituminous and subbituminous coals will be the fuels. Emissions of SO_2, and NO_x, from the plant will be controlled using TRW's slagging coal combustor with limestone injection, in conjunction with a boiler supplied by Foster Wheeler. Further SO_2, and particulate removal will be accomplished using Joy Technologies, Inc.'s (Joy) Activated Recycle Spray Absorber System. Successful demonstration of these technologies is expected to result in NO_x, emissions of less than 0.2 lb/MMBtu and SO_2, removal efficiencies greater than 90 percent. The heart of the system being demonstrated is a combustion

system. Each combustor consists of two cylindrical sections followed by a short duct that connects the combustor to the boiler. A precombustor burns about 35 percent of the coal to preheat the main combustor secondary air. The preheated air enters the main combustor section tangentially to impart a swirling motion to the coal and air. The balance of the coal is injected axially through multiple injection ports at the front end of this cylindrical section.

27632 (DOE/PC/92158–T7) **Engineering development of advanced coal-fired low emission boiler systems: First quarterly report, FY94, January 1994–March 1994.** Riley Stoker Corp., Worcester, MA (United States). [1994]. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC22-92PC92158. Order Number DE94016005. Source: OSTI; NTIS; GPO Dep.

The major task during this quarter was testing and evaluation of the 25 MBtu/hr Toroidal Vortex Combustor (TVC) at Textron Defense Systems" (TDS) Haverhill laboratories. The tests were completed and the results are being evaluated along with other scale up and integration issues. The preliminary conclusion is that the NOx performance and current design uncertainties do not justify the development risk within the Low Emission Boiler System (LEBS) timetable. Further program effort will focus on advanced U-firing arrangements. The second major effort during the period was the engineering development of the moving bed copper oxide system for SOx/NOx control. Through application of a DOE-developed model and the team's engineering analysis, significant progress was made on developing an improved process design. Work began on a small scale test of the moving bed concept under realistic temperature and dust loading conditions. Work continued through the quarter on finalizing the Preliminary Engineering Design, Design Deficiency Analysis, and Research, Development, and Test Plan. The Design and Development Report containing these three deliverables was released in March. Sargent & Lundy printed and distributed the report to team members, as well as to the advisory panelists. The advisory panel numbers approximately fifteen organizations as of the end of the period.

2002 Waste Management

Refer also to citation(s) 27192, 27210, 27211, 27219, 27630, 27631

27633 (CONF-940320–1) **Development and design of an advanced coal-fired low-emission boiler system.** Regan, J.W. (ABB/Combustion Engineering, Inc., Windsor, CT (United States)); Borio, R.W.; Hargrove, M.J.; Palkes, M.; Wesnor, J.D.; Kaminski, R.S. ABB/Combustion Engineering, Inc., Windsor, CT (United States). [1994]. 13p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC22-92PC92159. From Coal utilization and fuel systems: the greening of coal; Clearwater, FL (United States); 21-24 Mar 1994. Order Number DE94014849. Source: OSTI; NTIS; GPO Dep.

Combustion Engineering, Inc. of ABB is one of three contractors for Phase 1 of the US Department of Energy (DOE) four-phase Project for "Engineering Development of Advanced Coal-Fired Low Emission Boiler Systems" (LEBS). This is one of two projects in the DOE's "Combustion 2000" Program. The LEBS Project's primary objective is to limit SO_x and NO_x emissions to one-third New Source Performance Standards (NSPS) requirements and particulates to one-half NSPS requirements. The secondary objectives are to meet these emission levels without increasing plant heat rate or cost of electricity, to reduce the amount of waste produced, and to make the waste more readily disposable. The final deliverables will be a design data base that will allow future pulverized coal-fired plants to meet the stated objectives, and a preliminary design of a commercial generating unit. This paper reports the results of Phase 1A, the status of Phase 1B, and plans for future work. Phase 1A was devoted to producing the Management Plan for all four Phases, concept development and evaluation, subsystem preliminary design, design uncertainties analysis, and a research and development plan for Phase 1B. Work in Phase 1B consists of component definition, the preliminary design of a commercial generating unit (CGU), and research and development plans for Phase 2. The contractor(s) selected for Phase 2 will conduct pilot scale testing of advanced subsystems; for Phase 3 they will update the CGU design and engineer a system proof-of-concept test facility (POC); for Phase 4 they will carry out detailed engineering, construction, and testing of the POC.

27634 (DOE/PC/90547–T15) **Evaluation of Gas-Reburning and Low NO_x Burners on a wall fired boiler: [Quarterly] technical progress report No. 15, April 1–June 30, 1994.** Energy and Environmental Research Corp., Irvine, CA (United States). 15 Jul 1994. 17p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FC22-91PC90547. Order Number DE94016003. Source: OSTI; NTIS; GPO Dep.

Clean Coal Technology (CCT) implies the use of coal in an environmentally acceptable manner. Coal combustion results in the emission of oxides of nitrogen (No), which are precursors of both acid rain and ozone formation. The primary objective of this CCT project is to evaluate the use of Gas Reburning and Low NO_x Burners (GR-LNB) for NO_x emission control from a wall fired boiler. It is anticipated that, if the demonstration is successful, the GR-LNB technology could become commercialized during the 1 990' s and will be capable of (1) achieving significant reduction in the emissions of nitrogen oxides and sulfur dioxide (another acid rain precursor) from existing facilities to minimize environmental impacts such as transboundary and interstate pollution and/or (2) providing for future energy needs in an environmentally acceptable manner. Low NO_x burners are designed to delay the mixing of the coal fuel with combustion air to minimize the NO_x formation. Typically, one may obtain up to 50% reduction in NO_x emissions through the use of LNB. For LNB applications, the technology is developed and a number of LNB designs are commercially available. With GR, about 80–85 percent of the coal fuel is fired in the main combustion zone. The balance of the fuel is added downstream as natural gas to create a slightly fuel rich environment in which NO_x is converted to N_2. The combustion process is completed by over-fire air addition. SO_x emissions are reduced to the extent that natural gas replaces sulfur-containing coal. The level of NO_x reduction achievable with 15–20% natural gas is on the order of 50–60%. Thus the emission reduction target of the combination of these two developed technologies is about 70%.

27635 (WSRC-MS–94-0130) **Coal fired powerhouse wastewater pressure filtration.** Martin, H.L.; Diener, G.A. Westinghouse Savannah River Co., Aiken, SC (United States). [1994]. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035. (CONF-9405145–1: 1994 American Filtration and Separation Society national meeting, Chicago, IL (United States), 9-11 May 1994). Order Number DE94011673. Source: OSTI; NTIS; GPO Dep.

The Savannah River Site's permit for construction of an industrial wastewater treatment facility to remove solids from the boiler blowdown and wet ash scrubber effluent of the A-Area coal fired powerhouse was rejected. Conventional clarification technology would not remove arsenic from the combined effluent sufficient to achieve human health criteria in the small receiving surface stream. Treatability studies demonstrated that an existing facility, which will no longer be needed for metal finishing wastewater, can very efficiently process the powerhouse wastewater to less than 35 μg/L arsenic. Use of cationic and anionic polymers to flocculate both the wastewater and filter aid solids formed a "bridged cake" with exceptionally low resistance to flow. This will double the capacity of the Oberlin pressure filters with the Tyvek T-980 sub micron filter media. The affects of high sheer agitation and high temperature in the raw wastewater on the filtration process were also studied and adequate controls were demonstrated.

21 NUCLEAR POWER REACTORS AND ASSOCIATED PLANTS

27636 (CAN/CSA-N–286.0-92) **Overall quality assurance program requirements for nuclear power plants.** Canadian Standards Association, Rexdale, ON (Canada). Sep 1992. 36p. Order Number DE94632642. Source: OSTI; NTIS (US Sales Only); INIS.

This standard contains the requirements for the owner's overall quality assurance program for a nuclear power plant. This program encompasses all phases of a nuclear power plant life cycle, including site evaluation, design, procurement, manufacturing,

construction and installation, commissioning, operation, and decommissioning. It covers the activities associated with specifying, directing, and administering the work to be done during these phases, and the evaluation and integrated of the activities and programs of participants.

27637 (NUREG–0540-Vol.16-No.5) **Title list of documents made publicly available: Volume 16, Number 5.** Nuclear Regulatory Commission, Washington, DC (United States). Div. of Freedom of Information and Publications Services. Jul 1994. 319p. Sponsored by Nuclear Regulatory Commission, Washington, DC (United States). Source: OSTI; NTIS; INIS; GPO.

The Title List of Documents Made Publicly Available contains descriptions of the information received and generated by the US Nuclear Regulatory Commission (NRC). This information includes (1) docketed material associated with civilian nuclear power plants and other uses of radioactive materials and (2) nondocketed material received and generated by NRC pertinent to its role as a regulatory agency. As used here, docketed does not refer to Court dockets; it refers to the system by which NRC maintains its regulatory records. This series of documents is indexed by a Personal Author Index, a Corporate Source Index, and a Report Number Index.

27638 (STUK/YVL-GUIDE–1.9) **Quality assurance during operation of nuclear power plants.** Finnish Centre for Radiation and Nuclear Safety (STUK), Helsinki (Finland). 1994. 14p. Translation of the original text in Finnish which is published under the same guide number. Order Number DE94632643. Source: OSTI; NTIS; INIS.

The guide is valid from 15 January 1992 and will remain in force until further notice.

The general requirements applicable to the quality assurance of the Finnish nuclear power plants are presented in the Council of State Decision (395/91) and in the guide YVL 1.4. This guide specifies the quality assurance requirements to be applied during the operation of the nuclear power plants as well as of the other nuclear facilities. Quality assurance applies to all the activities and organizations with a bearing on the safe operation of the nuclear power plants. (5 refs.).

27639 (STUK/YVL-GUIDE–2.5) **Pre-operational and start-up testing of nuclear power plants.** Finnish Centre for Radiation and Nuclear Safety (STUK), Helsinki (Finland). 1994. 11p. Translation of the original text in Finnish which is published under the same guide number. Order Number DE94632644. Source: OSTI; NTIS; INIS.

The guide is valid from 1 April 1991 and will remain in force until further notice. It replaces the guide YVL 2.5 issued on 30 June 1976.

The general requirements for and regulatory control of the nuclear power plant pre-operational and start-up testing are specified in the guide. The pre-operational and start-up testing aims to demonstrate that the plant has been constructed and operates according to the design intent. In Finland the Finnish Centre for Radiation and Nuclear Safety controls the pre-operational and start-up testing of the nuclear power plants. For applicable parts the guide is also observed in the regulatory control of pre-operational and start-up testing of other nuclear facilities. (7 refs.).

2101 Power Reactors, Nonbreeding, Light-Water Moderated, Boiling Water Cooled

Refer also to citation(s) 27268, 27650, 27775, 27778, 27899, 27908, 28561

27640 (ECN-C–93-065) **Emission computer tomography on a Dodewaard mixed oxide fuel pin: Comparative PIE work with non-destructive and destructive techniques.** Buurveld, H.A.; Dassel, G. Netherlands Energy Research Foundation (ECN), Petten (Netherlands). Dec 1993. 214p. Project Number ECN 1306. Order Number DE94789634. Source: OSTI; NTIS; INIS.

A nondestructive technique as well as a destructive PIE technique have been used to verify the results obtained with a newly 8-e computer tomography (GECT) system. Multi isotope Scanning (MIS), electron probe micro analysis (EPMA) and GECT were used on a mixed oxide (MOX) fuel rod from the Dodewaard reactor with an average burnup of 24 MWd/kg fuel. GECT shows migration of Cs to the periphery of fuel pellets and to radial cracks and pores in the fuel, whereas MIS shows Cs migration to pellet interfaces. The EPMA technique appeared not to be useful to show migration of Cs but, it shows the distribution of fission products from Pu. EPMA clearly shows the distribution of fission products from Pu, but did not reveal the Cs-migration. (orig./HP)

27641 (NEA-NSC-DOC–93-25) **Results of LWR core transient benchmarks.** Finnemann, H.; Bauer, H.; Galati, A.; Martinelli, R. Nuclear Energy Agency, 75 - Paris (France). Oct 1993. 80p. Order Number DE94632653. Source: OSTI; NTIS (US Sales Only); INIS.

LWR core transient (LWRCT) benchmarks, based on well defined problems with a complete set of input data, are used to assess the discrepancies between three-dimensional space-time kinetics codes in transient calculations. The PWR problem chosen is the ejection of a control assembly from an initially critical core at hot zero power or at full power, each for three different geometrical configurations. The set of problems offers a variety of reactivity excursions which efficiently test the coupled neutronic/thermal - hydraulic models of the codes. The 63 sets of submitted solutions are analyzed by comparison with a nodal reference solution defined by using a finer spatial and temporal resolution than in standard calculations. The BWR problems considered are reactivity excursions caused by cold water injection and pressurization events. In the present paper, only the cold water injection event is discussed and evaluated in some detail. Lacking a reference solution the evaluation of the 8 sets of BWR contributions relies on a synthetic comparative discussion. The results of this first phase of LWRCT benchmark calculations are quite satisfactory, though there remain some unresolved issues. It is therefore concluded that even more challenging problems can be successfully tackled in a suggested second test phase. (authors). 46 figs., 21 tabs., 3 refs.

27642 (NUREG/CR–4667-Vol.17) **Environmentally assisted cracking in Light Water Reactors: Semiannual report, April 1993–September 1993: Volume 17.** Chopra, O.K. (Argonne National Lab., IL (United States)); Chung, H.M.; Karlsen, T.; Kassner, T.F.; Michaud, W.F.; Ruther, W.E.; Sanecki, J.E.; Shack, W.J.; Soppet, W.K. Nuclear Regulatory Commission, Washington, DC (United States). Div. of Engineering; Argonne National Lab., IL (United States). Jun 1994. 56p. Sponsored by Nuclear Regulatory Commission, Washington, DC (United States). DOE Contract W-31109-ENG-38. (ANL–94/16-Vol.17). Source: OSTI; NTIS; INIS.

This report summarizes work performed by Argonne National Laboratory on fatigue and environmentally assisted cracking (EAC) in light water reactors (LWRS) during the six months from April 1993 to September 1993. EAC and fatigue of piping, pressure vessels, and core components in LWRs are important concerns as extended reactor lifetimes are envisaged. Topics that have been investigated include (a) fatigue of low-alloy steel used in piping, steam generators, and reactor pressure vessels; (b) EAC of cast stainless steels (SSs); and (c) radiation-induced segregation and irradiation-assisted stress corrosion cracking of Type 304 SS after accumulation of relatively high fluence. Fatigue tests were conducted on medium-sulfur-content A106-Gr B piping and A533-Gr B pressure vessel steels in simulated PWR water and in air. Additional crack growth data were obtained on fracture-mechanics specimens of cast austenitic SSs in the as-received and thermally aged conditions in simulated boiling-water reactor (BWR) water at 289°C. The data were compared with predictions based on crack growth correlations for wrought austenitic SS in oxygenated water developed at ANL and rates in air from Section 11 of the ASME Code. Microchemical and microstructural changes in high- and commercial-purity Type 304 SS specimens from control-blade absorber tubes and a control-blade sheath from operating BWRs were studied by Auger electron spectroscopy and scanning electron microscopy.

27643 (NUREG/CR–6121) **Component evaluation for intersystem loss-of-coolant accidents in advanced light water reactors.** Ware, A.G. Nuclear Regulatory Commission, Washington, DC (United States). Div. of Engineering; Idaho National Engineering Lab., Idaho Falls, ID (United States). Jul 1994. 125p. Sponsored by Nuclear Regulatory Commission, Washington, DC

(United States). DOE Contract AC07-76ID01570. (EGG–2717). Source: OSTI; NTIS; INIS; GPO.

Using the methodology outlined in NUREG/CR-5603 this report evaluates (on a probabilistic basis) design rules for components in ALWRs that could be subjected to intersystem loss-of-coolant accidents (ISLOCAs). The methodology is intended for piping elements, flange connections, on-line pumps and valves, and heat exchangers. The NRC has directed that the design rules be evaluated for BWR pressures of 7.04 MPa (1025 psig), PWR pressures of 15.4 MPa (2235 psig), and 177°C (350°F), and has established a goal of 90% probability that system rupture will not occur during an ISLOCA event. The results of the calculations in this report show that components designed for a pressure of 0.4 of the reactor coolant system operating pressure will satisfy the NRC survival goal in most cases. Specific recommendations for component strengths for BWR and PWR applications are made in the report. A peer review panel of nationally recognized experts was selected to review and critique the initial results of this program.

2102 Power Reactors, Nonbreeding, Light-Water Moderated, Nonboiling Water Cooled

Refer also to citation(s) 27268, 27640, 27641, 27642, 27670, 27704, 27744, 27766, 27767, 27774, 27776, 27778, 27899, 27908, 28561

27644 (ECN-I–93-033) **Validation of the 172 groups JEF2.2 library (EJ2-XMAS) by the Rowlands PWR pin cell benchmark.** Wang, Y.; Kloosterman, J.L.; Hogenbirk, A. Netherlands Energy Research Foundation (ECN), Petten (Netherlands). Feb 1994. 25p. Order Number DE94789640. Source: OSTI; NTIS; INIS.

The new library in the XMAS group structure is based on the JEF2.2 evaluated nuclear data file. The calculations are done with the PASC-3 code system supplemented with some new codes from the SCALE-4.0 package. The infinite multiplication factor k_{∞} and corresponding neutron balance contributions are compared with those obtained by using a library in the same group structure but based on JEF1.1, and with preliminary results obtained by AEA Technology Winfrith. The k_{∞} values are also compared with data obtained by CEA Cadarache. The differences between the k_{∞} values of ECN and AEA are about 0.16%, and between ECN and CEA about 0.3 to 0.45%. These differences cannot be fully explained. The differences between the ECN calculations with the EJ2-XMAS library and the corresponding library based on the JEF1.1 file, range from 0.07 to 0.3%, and are probably due to differences in cross section data of oxygen and natural zirconium. A significant change of k_{∞} values of about 0.25% is found when resonance shielding is applied to natural zirconium in the cladding. This change becomes much smaller, however, when zirconium is composed of its isotopes and resonance shielding is applied to each isotope individually. Because a k_{∞} change of 0.25% due to resonance shielding in the zirconium cladding seems quite large, it is recommended not to use self-shielded cross sections for natural zirconium, but to use cross sections for natural zirconium at infinite dilution or to compose zirconium of its isotopes and to apply resonance self-shielding to each isotope individually. Differences between group-wise discrete ordinates and point-wise Monte Carlo calculations range up to 0.3%, which are due to differences in calculational methods and approximations made in group-wise descrete ordinates methods. (orig.)

27645 (IAEA-TECDOC–749) **Generic initiating events for PSA for WWER reactors.** International Atomic Energy Agency, Vienna (Austria). Jun 1994. 69p. Order Number DE94632659. Source: OSTI; NTIS (US Sales Only); INIS.

The objective of this document is to present the results of defining the initiating events (IEs) for WWERs which were obtained within the framework of the TC Project RER/9/005, 'PSA for WWER Type Reactors'. Generic IE lists and IE frequencies based on operational experience are presented and discussed. The purpose of this document is in a way similar to that of the widely used EPRI 2230. The scope of the report is limited to the results accomplished within the framework of the project. National activities related to the topic are described when relevant for the overall project. The report is not intended to give detailed guidance to perform definition of IEs for plant specific PSA. Other IAEA documents are available for this purpose (e.g. Manual for Defining Initiating Event for PSA Uses). This report present the generic lists of initiators for both WWER reactor types (440 and 1000) which has been agreed upon by all WWER operators. In addition, the frequencies of more frequent initiators (transients) fully based on collected operating experience are presented. Frequencies of rare events (LOCAs) as used in several on going PSA projects are also tabulated. 11 refs, 1 fig., tabs.

27646 (JAERI-M–94-069) **Data report for ROSA-IV LSTF gravity-driven safety injection experiment run SB-CL-27.** Yonomoto, Taisuke (Japan Atomic Energy Research Inst., Tokai, Ibaraki (Japan). Tokai Research Establishment); Saitou, Seishi; Kuroda, Takeshi. Japan Atomic Energy Research Inst., Tokyo (Japan). Mar 1994. 157p. Order Number DE94785272. Source: OSTI; NTIS; INIS.

Experimental data are presented for the passive injection test, Run SB-CL-27, conducted at the ROSA-IV Large Scale Test Facility (LSTF) on September 17, 1992. This experiment simulated thermal-hydraulic behavior of a gravity-driven, passive safety injection system during a small-break loss-of-coolant accident (LOCA) in a pressurized water reactor (PWR). The injection system consisted of a gravity-driven injection tank, located above the reactor vessel, with connecting lines. The tank was initially filled with water of room temperature at the same pressure as the pressurizer. The connecting lines to the cold leg and to the vessel downcomer were opened at the test initiation. Then, a natural circulation flow developed in the loop which was formed by these lines and the injection tank. The hot water in the cold leg circulated into the upper part of tank and accumulated there causing a significant thermal stratification. This thermal stratification prevented direct-contact condensation of steam from occurring during the subsequent tank drain-down phase. Therefore, no condensation-induced depressurization of the tank, affecting adversely the injection performance, occurred. (author).

27647 (NUREG/CR–6143-Vol.2-Pt.4) **Evaluation of potential severe accidents during low power and shutdown operations at Grand Gulf, Unit 1: Analysis of core damage frequency from internal events for plant operational state 5 during a refueling outage. Internal events appendices K to M.** Forester, J. (Science Applications International Corp., Albuquerque, NM (United States)); Yakle, J.; Walsh, B.; Darby, J.; Whitehead, D.; Staple, B.; Brown, T. Nuclear Regulatory Commission, Washington, DC (United States). Div. of Safety Issue Resolution; Sandia National Labs., Albuquerque, NM (United States). Jul 1994. 883p. Sponsored by Nuclear Regulatory Commission, Washington, DC (United States). DOE Contract AC04-94AL85000. (SAND–93-2440-Vol.2-Pt.4). Source: OSTI; NTIS; GPO; INIS.

This report provides supporting documentation for various tasks associated with the performance of the probabilistic risk assessment for Plant Operational State 5 (approximately Cold Shutdown as defined by Grand Gulf Technical Specifications) during a refueling outage at Grand Gulf, Unit 1 as documented in Volume 2, Part 1 of NUREG/CR-6143. The report contains the following appendices: K - HEP Locator Files; L - Supporting Information for the Plant Damage State Analysis; M - Summary of Results from the Coarse Screening Analysis - Phase 1A.

27648 (NUREG/CR–6144-Vol.2-Pt.3B) **Evaluation of potential severe accidents during low power and shutdown operations at Surry, Unit 1: Analysis of core damage frequency from internal events during mid-loop operations: Appendix E (Sections E.9-E.16), Volume 2, Part 3B.** Chu, T.L. (Brookhaven National Lab., Upton, NY (United States)); Musicki, Z.; Kohut, P.; Yang, J.; Bozoki, G.; Hsu, C.J.; Diamond, D.J.; Wong, S.M.; Bley, D.; Johnson, D. Nuclear Regulatory Commission, Washington, DC (United States). Div. of Safety Issue Resolution; Brookhaven National Lab., Upton, NY (United States). Jun 1994. 495p. Sponsored by Nuclear Regulatory Commission, Washington, DC (United States). DOE Contract AC02-76CH00016. (BNL-NUREG–52399-Vol.2-Pt.3B). Source: OSTI; NTIS; INIS; GPO.

Traditionally, probabilistic risk assessments (PRA) of severe accidents in nuclear power plants have considered initiating events

potentially occurring only during full power operation. Some previous screening analyses that were performed for other modes of operation suggested that risks during those modes were small relative to full power operation. However, more recent studies and operational experience have implied that accidents during low power and shutdown could be significant contributors to risk. Two plants, Surry (pressurized water reactor) and Grand Gulf (boiling water reactor), were selected as the plants to be studied. The objectives of the program are to assess the risks of severe accidents initiated during plant operational states other than full power operation and to compare the estimated core damage frequencies, important accident sequences and other qualitative and quantitative results with those accidents initiated during full power operation as assessed in NUREG-1150. The scope of the program includes that of a level-3 PRA. In phase 2, mid-loop operation was selected as the plant configuration to be analyzed based on the results of the phase 1 study. The objective of the phase 2 study is to perform a detailed analysis of the potential accident scenarios that may occur during mid-loop operation, and compare the results with those of NUREG-1150. The scope of the level-1 study includes plant damage state analysis, and uncertainty analysis. Volume 1 summarizes the results of the study. Internal events analysis is documented in Volume 2. It also contains an appendix that documents the part of the phase 1 study that has to do with POSs other than mid-loop operation. Internal fire and internal flood analyses are documented in Volumes 3 and 4. A separate study on seismic analysis, documented in Volume 5, was performed for the NRC by Future Resources Associates, Inc. Volume 6 documents the accident progression, source terms, and consequence analysis.

27649 (NUREG/CR–6144-Vol.2-Pt.4) **Evaluation of potential severe accidents during low power and shutdown operations at Surry, Unit-1: Analysis of core damage frequency from internal events during mid-loop operations: Appendices F-H, Volume 2, Part 4.** Chu, T.L. (Brookhaven National Lab., Upton, NY (United States)); Musicki, Z.; Kohut, P.; Yang, J.; Bozoki, G.; Hsu, C.J.; Diamond, D.J.; Bley, D.; Johnson, D.; Holmes, B. Nuclear Regulatory Commission, Washington, DC (United States). Office of Nuclear Regulatory Research; Brookhaven National Lab., Upton, NY (United States). Jun 1994. 605p. Sponsored by Nuclear Regulatory Commission, Washington, DC (United States). DOE Contract AC02-76CH00016. (BNL-NUREG–52399-Vol.2-Pt.4). Source: OSTI; NTIS; INIS; GPO.

Traditionally, probabilistic risk assessments (PRA) of severe accidents in nuclear power plants have considered initiating events potentially occurring only during full power operation. Some previous screening analyses that were performed for other modes of operation suggested that risks during those modes were small relative to full power operation. However, more recent studies and operational experience have implied that accidents during low power and shutdown could be significant contributors to risk. Two plants, Surry (pressurized water reactor) and Grand Gulf (boiling water reactor), were selected as the plants to be studied. The objectives of the program are to assess the risks of severe accidents initiated during plant operational states other than full power operation and to compare the estimated core damage frequencies, important accident sequences and other qualitative and quantitative results with those accidents initiated during full power operation as assessed in NUREG-1150. The scope of the program includes that of a level-3 PRA. In phase 2, mid-loop operation was selected as the plant configuration to be analyzed based on the results of the phase 1 study. The objective of the phase 2 study is to perform a detailed analysis of the potential accident scenarios that may occur during mid-loop operation, and compare the results with those of NUREG-1150. The scope of the level-1 study includes plant damage state analysis, and uncertainty analysis. Volume 1 summarizes the results of the study. Internal events analysis is documented in Volume 2. It also contains an appendix that documents the part of the phase 1 study that has to do with POSs other than mid-loop operation. Internal fire and internal flood analyses are documented in Volumes 3 and 4. A separate study on seismic analysis, documented in Volume 5, was performed for the NRC by Future Resources Associates, Inc. Volume 6 documents the accident progression, source terms, and consequence analysis.

27650 (NUREG/CR–6144-Vol.2-Pt.5) **Evaluation of potential severe accidents during low power and shutdown operations at Surry, Unit-1: Analysis of core damage frequency from internal events during mid-loop operations: Appendix I, Volume 2, Part 5.** Chu, T.L. (Brookhaven National Lab., Upton, NY (United States)); Musicki, Z.; Kohut, P.; Yang, J.; Bozoki, G.; Hsu, C.J.; Diamond, D.J.; Bley, D.; Johnson, D.; Holmes, B. Nuclear Regulatory Commission, Washington, DC (United States). Office of Nuclear Regulatory Research; Brookhaven National Lab., Upton, NY (United States). Jun 1994. 309p. Sponsored by Nuclear Regulatory Commission, Washington, DC (United States). DOE Contract AC02-76CH00016. (BNL-NUREG–52399-Vol.2-Pt.5). Source: OSTI; NTIS; INIS; GPO.

Traditionally, probabilistic risk assessments (PRA) of severe accidents in nuclear power plants have considered initiating events potentially occurring only during full power operation. Some previous screening analyses that were performed for other modes of operation suggested that risks during those modes were small relative to full power operation. However, more recent studies and operational experience have implied that accidents during low power and shutdown could be significant contributors to risk. During 1989, the Nuclear Regulatory Commission (NRC) initiated an extensive program to carefully examine the potential risks during low power and shutdown operations. The program includes two parallel projects being performed by Brookhaven National Lab. (BNL) and Sandia National Labs. (SNL). Two plants, Surry (pressurized water reactor) and Grand Gulf (boiling water reactor), were selected as the plants to be studied. The objectives of the program are to assess the risks of severe accidents initiated during plant operational states other than full power operation and to compare the estimated core damage frequencies, important accident sequences and other qualitative and quantitative results with those accidents initiated during full power operation as assessed in NUREG-1150. The objective of this volume of the report is to document the approach utilized in the level-1 internal events PRA for the Surry plant, and discuss the results obtained. A phased approach was used in the level-1 program. In phase 1, which was completed in Fall 1991, a coarse screening analysis examining accidents initiated by internal events (including internal fire and flood) was performed for all plant operational states (POSs). The objective of the phase 1 study was to identify potential vulnerable plant configurations, to characterize (on a high, medium, or low basis) the potential core damage accident scenarios, and to provide a foundation for a detailed phase 2 analysis.

27651 (STUK-B-YTO–116) **Operation of Finnish nuclear power plants: Quarterly report 3rd quarter, 1993.** Tossavainen, K. (ed.). Finnish Centre for Radiation and Nuclear Safety (STUK), Helsinki (Finland). Mar 1994. 22p. Order Number DE94632660. Source: OSTI; NTIS; INIS.

Published also in Finnish as report number STUK-B-YTO–115.

In the third quarter of 1993, all of Finland's four nuclear power plant units were in power operation, with the exception of the annual maintenance outages of the Loviisa units. The load factor average of the plant units was 83.6 %. None of the events which occurred during this annual quarter had any bearing on nuclear or radiation safety. (4 figs., 5 tabs.).

2103 Power Reactors, Nonbreeding, Graphite Moderated

Refer also to citation(s) 27680, 27733, 27746, 28898, 28899

2104 Power Reactors, Nonbreeding, Otherwise Moderated Or Unmoderated

Refer also to citation(s) 27725, 27765, 27770

27652 (AECL–10777, pp. 248-258) **Independence and diversity in CANDU shutdown systems.** Williams, G.N. (Atomic Energy of Canada Ltd., Chalk River, ON (Canada). Chalk River Nuclear Labs.); Huget, R.G. Atomic Energy of Canada Ltd., Chalk River, ON (Canada). Chalk River Nuclear Labs. Feb 1993. (CONF-9209425–: International Working Group on Nuclear Power Plant

Control and Instrumentation, Chalk River (Canada), 8-11 Sep 1992). In *Proceedings.* 330p. Order Number DE94632739. Source: OSTI; NTIS (US Sales Only); INIS.

Atomic Energy Control Board regulations state that Canadian CANDU reactors shall have two fully effective, independent and diverse shutdown systems. The Darlington Nuclear Generating Station is the first power plant operated by Ontario Hydro to make use of software-based computer control in its shutdown systems. By virtue of the reliance placed on these systems to prevent exposure of the public to harmful radioactivity in the event of an accident, the shutdown system software has been categorized as safety critical software. An important issue that was considered in the design of the Darlington shutdown systems was how the software should be designed and incorporated into the systems to comply with the independence and diversity requirement. This paper describes how the independence and diversity requirement was complied with in previous CANDU shutdown system designs utilizing hardware components. The difference between systems utilizing hardware alone, and those utilizing both hardware and software are discussed. The results of a literature search into the issue of software diversity, the behaviour of multi-version software systems, and experience in other industries utilizing safety critical software are referred to. This paper advocates a systems approach to designing independent shutdown systems utilizing software. Opportunities exist at the system level for design decisions that can enhance software diversity and can reduce the likelihood of common mode faults in the systems. In the light of recent experience in implementing diverse safety critical software, potential improvements to the design process for CANDU shutdown systems are identified. (Author) 19 refs.

27653 (AECL–10777, pp. 259-267) **The Ontario Hydro/AECL approach to real-time software engineering standards.** Joannou, P.K. (Ontario Hydro, Toronto, ON (Canada)); Harauz, J.; Tremaine, D.R.; Ichiyen, N. Atomic Energy of Canada Ltd., Chalk River, ON (Canada). Chalk River Nuclear Labs. Feb 1993. (CONF-9209425–: International Working Group on Nuclear Power Plant Control and Instrumentation, Chalk River (Canada), 8-11 Sep 1992). In *Proceedings.* 330p. Order Number DE94632739. Source: OSTI; NTIS (US Sales Only); INIS.

Software is increasingly becoming a component of many systems within CANDU nuclear generating stations, including special safety systems. There are no widely accepted standards to which software may be engineered that provide adequate assurance that the software will be of acceptable quality. Ontario Hydro, AECL CANDU and AECL Research have initiated a joint development program to establish standards, methods and tools for software engineering to be used in control, protective and monitoring systems. This paper describes the need for standards, the framework for the set of standards under development and how the standards are to be applied to a specific project. The result of the standards development work will be a set of standards to define the requirements on acceptable software processes and products, and a definition of the methodology that will be used by Ontario Hydro and AECL. The benefits of the standards development program and its relationship to national and international standards is discussed. This paper provides details on the initiatives and the status of the joint Ontario Hydro and AECL work program. (Author) 3 refs.

27654 (CAN/CSA-N–287.4-92) **Construction, fabrication, and installation: Requirements for concrete containment structures for CANDU nuclear power plants.** Canadian Standards Association, Rexdale, ON (Canada). May 1992. 49p. Order Number DE94632740. Source: OSTI; NTIS (US Sales Only); INIS.

This standard specifies the construction, fabrication, and installation requirements that apply to concrete containment structures of a containment system designated as class containment components, parts and appurtenances for nuclear power plants.

27655 (NUREG–1502) **Assessment of databases and modeling capabilities for the CANDU 3 design.** Carlson, D.E.; Meyer, R.O. Nuclear Regulatory Commission, Washington, DC (United States). Div. of Systems Research. Jul 1994. 100p. Sponsored by Nuclear Regulatory Commission, Washington, DC (United States). Source: OSTI; NTIS; INIS; GPO.

The NRC staff has been conducting a preliminary review of the CANDU 3 (Canadian Deuterium Uranium Model 3) reactor design, a new heavy-water design developed by Atomic Energy of Canada Limited through its US affiliate, AECL Technologies. The review has been aimed at identifying key technical areas and policy issues that will have to be addressed for standard design certification. As part of the research program associated with the preliminary review, the NRC Office of Nuclear Regulatory Research (RES) has completed an assessment of databases and modeling capabilities that might be needed to support the CANDU 3 design. To ensure full coverage of the design, a detailed assessment methodology was developed by the RES staff and was implemented with help from research projects at three national laboratories. This report integrates and summarizes the database and modeling assessments, including major contributions from these laboratories. 395 refs.

2105 Power Reactors, Breeding

Refer also to citation(s) 27267, 27274, 27529, 27530, 27914, 27915, 27916

27656 (KFK–5307) **Investigation of the fluid dynamics of a gas jet expansion in a liquid pool.** Meyer, L.; Wilhelm, D. Kernforschungszentrum Karlsruhe GmbH (Germany). Inst. fuer Neutronenphysik und Reaktortechnik. Mar 1994. 86p. Order Number DE94789739. Source: OSTI; NTIS (US Sales Only); INIS.

The injection of a high pressure gas into a stagnant liquid pool is the characteristic phenomenon during the expansion phase of a hypothetical core disruptive accient in liquid-metal fast breeder reactors. High pressure, high temperatyure fuel (UO_2) and steel vapor is driven out of the damaged core region into the overlying pool of sodium. For the further development of the accident sequence the rate of mixing between the hot vapor and the relatively cold sodium is the decisive parameter. This report consists of two parts. In part A the results of ten experiments are presented. In par B the results of calculations with the AFDM-code are presented for six of these experiments. (orig./GL)

2107 Regulation and Licensing

Refer also to citation(s) 27377, 27378, 27637, 27638, 27665, 27670, 27817, 27818, 27819, 28905, 28907, 28908

27657 (AECL–10777, pp. 231-240) **Panel discussion: Software licensing issues.** Hohendorf, R.J. (Ontario Hydro, Toronto, ON (Canada)); Courtois, P.J.; Faya, A.; Ball, A.; Mauck, J. Atomic Energy of Canada Ltd., Chalk River, ON (Canada). Chalk River Nuclear Labs. Feb 1993. (CONF-9209425–: International Working Group on Nuclear Power Plant Control and Instrumentation, Chalk River (Canada), 8-11 Sep 1992). In *Proceedings.* 330p. Order Number DE94632739. Source: OSTI; NTIS (US Sales Only); INIS.

Regulators from Belgium, Canada, the United Kingdom, and the United States discuss their concerns regarding the licensing of software for safety-critical systems. (L.L.).

27658 (NUREG–0711) **Human factors engineering program review model.** Nuclear Regulatory Commission, Washington, DC (United States). Div. of Reactor Controls and Human Factors. Jul 1994. 92p. Sponsored by Nuclear Regulatory Commission, Washington, DC (United States). Source: OSTI; NTIS; INIS; GPO.

The staff of the Nuclear Regulatory Commission is performing nuclear power plant design certification reviews based on a design process plan that describes the human factors engineering (HFE) program elements that are necessary and sufficient to develop an acceptable detailed design specification and an acceptable implemented design. There are two principal reasons for this approach. First, the initial design certification applications submitted for staff review did not include detailed design information. Second, since human performance literature and industry experiences have shown that many significant human factors issues arise early in the design process, review of the design process activities and results is important to the evaluation of an overall design. However, current regulations and guidance documents do not address the criteria for design process review. Therefore, the HFE Program Review Model (HFE PRM) was developed as a basis for performing design certification reviews that include design process evaluations as well as review of the final design. A central tenet of the HFE PRM is that

the HFE aspects of the plant should be developed, designed, and evaluated on the basis of a structured top-down system analysis using accepted HFE principles. The HFE PRM consists of ten component elements. Each element in divided into four sections: Background, Objective, Applicant Submittals, and Review Criteria. This report describes the development of the HFE PRM and gives a detailed description of each HFE review element.

27659 (NUREG–0940-Vol.13-No.1-Pt.1) **Enforcement actions: Significant actions resolved reactor licensees: Volume 13, No. 1, Part 1: Quarterly progress report, January–March 1994.** Nuclear Regulatory Commission, Washington, DC (United States). Office of Enforcement. Jun 1994. 200p. Sponsored by Nuclear Regulatory Commission, Washington, DC (United States). Source: OSTI; NTIS; GPO; INIS.

This compilation summarizes significant enforcement actions that have been resolved during one quarterly period (January–March 1994) and includes copies of letters, Notices, and Orders sent by the Nuclear Regulatory Commission to reactor licensees with respect to these enforcement actions. It is anticipated that the information in this publication will be widely disseminated to managers and employees engaged in activities licensed by the NRC, so that actions can be taken to improve safety by avoiding future violations similar to these described in this publication.

2108 Economics

Refer also to citation(s) 27530, 27684, 27746

22 NUCLEAR REACTOR TECHNOLOGY

Refer also to citation(s) 27636

27660 (DOE/ER/75728–2) **Support of nuclear engineering education and research at the University of Michigan: Progress report, May 15, 1993–May 14, 1994.** Martin, W.R. Michigan Univ., Ann Arbor, MI (United States). Dept. of Nuclear Engineering. May 1994. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-92ER75728. Order Number DE94016226. Source: OSTI; NTIS; INIS; GPO Dep.

This report describes progress on four different projects in the fission reactor area that have been supported by the grant during the past year. These projects are: Accelerator transmutation of nuclear waste (Steve Pearson); Neutronic analysis of the Ford Nuclear Reactor (Brent Renkema); and Monte Carlo depletion capability and new perturbation Monte Carlo algorithms, with utilization of massively parallel processors (Amit Majumdar). These tasks are briefly described and progress to date is presented.

2201 Theory and Calculation

Refer also to citation(s) 27683, 27748, 28044

27661 (CNIC–00795) **Adaptation and development of reactor multigroup constants generation program.** Yang Shunhai (Academia Sinica, Beijing, BJ (China). Inst. of Atomic Energy); Yuan Xialin. China Nuclear Information Centre, Beijing, BJ (China). Nov 1993. 7p. (IAE–0126.). Order Number DE94632602. Source: OSTI; NTIS (US Sales Only); INIS.

The imported fast neutron multigroup constants generating FOURACES program, thermal neutron multigroup constants generating FLANGE-AE program and resonance self-shielding factor calculation MINX program are adapted and further developed to CYBER-825 computer, and the reactor multigroup constants generating RMCPP program package is developed. By using this package, the 63-group multigroup constants working file MC is generated and interconnected with the nuclear engineering criticality safety Monte Carlo NEMCS program. By which the effective multiplication factors of Pu and U systems are calculated, the primary results are satisfied.

27662 (HW–67754) **Nomogram for TAI equation.** Carlson, P.A. Pacific Northwest Lab., Richland, WA (United States). 12 Dec 1960. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE94017232. Source: OSTI; NTIS; GPO Dep.

A nomogram is attached as Figure 1 which may be used to determine TAI limits. The nomogram was developed to meet the need for a rapid and accurate method for calculating these limits. The technical basis for determining individual tube outlet temperature limits is given in HW-65729.

27663 (HW–84427) **One-group xenon reactivity calculations.** Fredsall, J.R.; Bowers, C.E. Pacific Northwest Lab., Richland, WA (United States). 2 Mar 1964. 23p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE94017235. Source: OSTI; NTIS; GPO Dep.

A study was initiated in the Pile Physics Unit to evaluate current methods for prediction of xenon behavior in light of newer operating conditions, and thus possibly improve the critical prediction accuracy. Particular areas considered included: (1) validation and limitations of the flux-squared weighting technique for homogenizing localized xenon effects, (ii) effect of elevated graphite temperature on xenon poisoning, (iii) xenon poisoning in the dry lattice, (iv) xenon-control rod interaction and mutual shadowing, and (v) effects of moderate to severe flux distortions. This document comprises the result of that study.

27664 (LA–12827-M) **Criticality calculations with MCNP™: A primer.** Mendius, P.W. (ed.); Harmon, C.D. II; Busch, R.D.; Briesmeister, J.F.; Forster, R.A. Los Alamos National Lab., NM (United States). Aug 1994. 175p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. Order Number DE94016577. Source: OSTI; NTIS; GPO Dep.

The purpose of this Primer is to assist the nuclear criticality safety analyst to perform computer calculations using the Monte Carlo code MCNP. Because of the closure of many experimental facilities, reliance on computer simulation is increasing. Often the analyst has little experience with specific codes available at his/her facility. This Primer helps the analyst understand and use the MCNP Monte Carlo code for nuclear criticality analyses. It assumes no knowledge of or particular experience with Monte Carlo codes in general or with MCNP in particular. The document begins with a Quickstart chapter that introduces the basic concepts of using MCNP. The following chapters expand on those ideas, presenting a range of problems from simple cylinders to 3-dimensional lattices for calculating keff confidence intervals. Input files and results for all problems are included. The Primer can be used alone, but its best use is in conjunction with the MCNP4A manual. After completing the Primer, a criticality analyst should be capable of performing and understanding a majority of the calculations that will arise in the field of nuclear criticality safety.

2202 Components and Accessories

Refer also to citation(s) 27570, 27651, 27652, 27711, 27712, 27714, 27758, 27773, 27901, 28051, 28905, 28906

27665 (NUREG/CR–5128-Rev.1) **Evaluation and refinement of leak-rate estimation models: Revision 1.** Paul, D.D. (Battelle, Columbus, OH (United States)); Ahmad, J.; Scott, P.M.; Flanigan, L.F.; Wilkowski, G.M. Nuclear Regulatory Commission, Washington, DC (United States). Div. of Engineering; Battelle, Columbus, OH (United States). Jun 1994. 94p. Sponsored by Nuclear Regulatory Commission, Washington, DC (United States). (BMI–2164-Rev.1). Source: OSTI; NTIS; GPO; INIS.

Leak-rate estimation models are important elements in developing a leak-beforebreak methodology in piping integrity and safety analyses. Existing thermalhydraulic and crack-opening-area models used in current leak-rate estimations have been incorporated into a single computer code for leak-rate estimation. The code is called SQUIRT, which stands for Seepage Quantification of Upsets In Reactor Tubes. The SQUIRT program has been validated by comparing its thermalhydraulic predictions with the limited experimental data that have been published on two-phase flow through slits and cracks, and by comparing its crack-opening-area predictions with data from the Degraded Piping Program. In addition, leak-rate

experiments were conducted to obtain validation data for a circumferential fatigue crack in a carbon steel pipe girth weld.

27666 (STUK/YVL-GUIDE-3.7) **Pressure vessels of nuclear facilities: Commissioning inspection.** Finnish Centre for Radiation and Nuclear Safety (STUK), Helsinki (Finland). 1993. 11p. Translation of the original text in Finnish which is published under the same guide number. Order Number DE94632608. Source: OSTI; NTIS; INIS.

The guide is valid from 15 January 1992 and will remain in force until further notice. It replaces the guide YVL 3.7 issued on 16 March 1976.

The general guidelines on the regulation concerning commissioning inspection of pressure vessels with its equipment and contents of inspection are given in the guide. A pressure vessel with its equipment must not be placed in service until it has been accepted in a commissioning inspection. In Finland the commissioning is carried out by an inspector of the Finnish Centre for Radiation and Nuclear Safety (STUK). (3 refs.).

27667 (WHC-SA-2277) **Safety considerations for condensation induced water hammer in steam piping system.** McCall, T.B. (Westinghouse Hanford Co., Richland, WA (United States)); Squarer, D.; Roidt, R.M. Westinghouse Hanford Co., Richland, WA (United States). Jun 1994. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-940630-28: 11. topical meeting on the technology of fusion energy, New Orleans, LA (United States), 19-24 Jun 1994). Order Number DE94015639. Source: OSTI; NTIS; GPO Dep.

The phenomenon of condensation induced water hammer may occur when subcooled water and steam interact and form a water slug by rapid steam condensation, and the slug is accelerated through the piping by the full system pressure. The sudden deceleration of the slug by existing liquid in the system, or by any part of the piping system can produce large pressure pulses, that by themselves or in combination with other loads, can rupture the piping system. This paper describes the results of a study on condensation induced water hammer in a specific piping geometry, and lists recommendations that when implemented will prevent piping system failure.

2203 Fuel Elements

Refer also to citation(s) 27295, 27682, 27683, 27705, 27714, 27718, 27748, 27752, 27753, 27754, 27755

27668 (HW-58715) **Bond strength evaluation of the brittle bond problem in production fuel elements.** Tverberg, J.C. Pacific Northwest Lab., Richland, WA (United States). 10 Nov 1958. 13p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE94017231. Source: OSTI; NTIS; GPO Dep.

Brittle bonds and the factors controlling their formation have been of substantial concern in the production of dip canned fuel elements. Detection of brittle bonds has been by the chisel test and by metallographic examinations. At best, these are qualitative tests and do not establish the degree of brittleness. For this reason bond tensile strength analysis has been suggested. Tests have been run to determine if a change in canning variables could be detected by a change in bond strength.

27669 (HW-62755) **GEH-4-42, 47; Hot pressed, I and E cooled fuel element irradiation.** Neidner, R. Battelle, Columbus, OH (United States). 2 Nov 1959. 13p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE94016265. Source: OSTI; NTIS; GPO Dep.

In our continual effort to improve the present fuel elements which are irradiated in the numerous Hanford reactors, we have made what we believe to be a significant improvement in the hot pressing process for jacketing uranium fuel slugs. We are proposing a large scale evaluation testing program in the Hanford reactors but need the vital and basic information on the operating characteristics of this type slug under known and controlled operating conditions. We, therefore, have prepared two typical fuel slugs and will want them irradiated to about 1000 MWD/T exposure (this will require about four to five total cycles).

2204 Control Systems

Refer also to citation(s) 27767, 28896, 28897, 28898, 28899, 28901

27670 (AECL-10777) **Proceedings.** Atomic Energy of Canada Ltd., Chalk River, ON (Canada). Chalk River Nuclear Labs. Feb 1993. 330p. (CONF-9209425--: International Working Group on Nuclear Power Plant Control and Instrumentation, Chalk River (Canada), 8-11 Sep 1992). Order Number DE94632739. Source: OSTI; NTIS (US Sales Only); INIS.

Twenty-four papers were presented at this conference attended by representatives from 16 countries. The papers discussed the design and implementation of control and instrumentation systems in nuclear power plants, the licensing of software by regulatory agencies, and life-cycle issues. (L.L.).

27671 (AECL-10777, pp. 151-164) **Evaluation methods for instrumentation and control safety softwares of nuclear power plants.** Soubies, B. (CEA Centre d'Etudes de Fontenay-aux-Roses, 92 (France). Dept. d'Evaluation de Surete); Lemeur, M.; Henry, J.Y.; Boulch, J. Atomic Energy of Canada Ltd., Chalk River, ON (Canada). Chalk River Nuclear Labs. Feb 1993. (CONF-9209425--: International Working Group on Nuclear Power Plant Control and Instrumentation, Chalk River (Canada), 8-11 Sep 1992). In *Proceedings.* 330p. Order Number DE94632739. Source: OSTI; NTIS (US Sales Only); INIS.

In France, the operating licence process of nuclear power plants has mandatory steps which include a detailed survey of nuclear reactor instrumentation and control (I and C). Use of microcomputer-based systems, like Integrated Digital Protection System (SPIN), which controls safety functions, has led to definition of particular provisions specific to the PWR 1300 MWe I and C. A first set of software dispositions has been established, which considers quality assurance aspects, organization of software development cycle in terms of phases, independence between software teams for development and validation, and tests on manufacturer's trial platform followed by tests on the first unit to complete the validation. Operating experience, obtained since startup in 1983, has led to improvements in maintenance procedures. Each new release of the software should be validated like for the initial design and in particular, tests have to be applied to the whole software, not only to the modified modules. At present, a new design of 1400 MWe nuclear plants I and C (PWR - N4 project) is under evaluation. The manufacturer has introduced important changes in the design and realization process of safety systems, especially for SPIN (CO3 - N4); these affect the programming and design methods, which are based on SAGA. This CASE tool has been designed for data acquisition and processing in a real-time system. These new methods need particular requirements to ensure that improvements of the testability and to guarantee the safety for this type of system. Moreover, automatic code generation and control configuration of the SAGA tool creates a need for validation of the full production line of the SPIN safety software. New methods used by the protection system manufacturer are explained. Methodology of safety software evaluation of the N4 project and associated criteria are set out. (Author) 2 refs.

27672 (CONF-941086-1) **Experimental validation of navigation workload metrics.** Schryver, J.C. (Oak Ridge National Lab., TN (United States)); Wachtel, J.A. Oak Ridge National Lab., TN (United States). [1994]. 9p. Sponsored by Nuclear Regulatory Commission, Washington, DC (United States). DOE Contract AC05-84OR21400. From 38. annual meeting of the Human Factors and Ergonomics Society; Nashville, TN (United States); 24-28 Oct 1994. Order Number DE94010127. Source: OSTI; NTIS; GPO Dep.

Advanced digital computer display interfaces in the control room may increase operator workload. Workstation monitors provide limited display area, and information is represented in large-scale display networks. Display navigation may generate disorienting effects, require additional resources for window management, and increase memory and data integration requirements. Six ORNL employees participated in an experiment to validate proposed metrics of navigation workload in the advanced control room. The task environment was a display network consisting of 25 windows resembling a simplified Safety Parameter Display System for Pressurized Water Reactors. A repeated measures design with 3 within

subjects factors was employed. The factors were task difficulty, navigation distance level, and a blocking factor. Participants were asked to monitor a single parameter or two parameters. Fourteen candidate metrics were tested. Analysis of variance of the modified task load index (MTLX) and rating subscales demonstrated substantial support for the claim that navigation of large-scale display networks can impose additional mental load. Primary and secondary task performance measures exhibited ceiling effects. Memory probes for these tasks were inadequate because they were recognition-based and coarse. Eye gaze measures were not validated, indicating a need for more refined data reduction algorithms. Strong positive correlations were found between MTLX and both navigation duration and standard deviation of pupil diameter. Further study and increased statistical power are required to validate objective navigation workload metrics.

27673 (DPW–56-179) **Orientation of control rods.** Babcock, D.F.; Bernath, L. Du Pont de Nemours (E.I.) and Co., Wilmington, DE (United States). Explosives Dept. 12 Mar 1956. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-76SR00001. (SR/H–769). Order Number DE94016648. Source: OSTI; NTIS; GPO Dep.

It was recommended that the control rods in the septifoils of the reactor be reoriented in order to improve flux shaping; burnout was not mentioned. This memorandum re-examines the problem of orientation of the control rods considering not only flux shaping but also burnout.

27674 (HW–60233-B) **Physics and Instrument Research and Development Operation: Monthly report, April 1959.** Gast, P.F. General Electric Co., Richland, WA (United States). Hanford Atomic Products Operation. 12 May 1959. 26p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE94016257. Source: OSTI; NTIS; GPO Dep.

Areas covered in this report are as follows: nuclear safety in the Fuel Preparation Dept.; studies related to the present production reactors; studies related to future production reactors; studies related to separation plants; studies form the neutron cross section program; reactor development (gas cooled reactor program and test reactor operations); and biology and medicine.

27675 (HW–60379) **Supplement C – Production test IP-64-CE poison column displacement during reactor operation.** Hedges, J.W.; Carter, R.D. General Electric Co., Richland, WA (United States). Hanford Atomic Products Operation. 16 Jun 1959. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE94016268. Source: OSTI; NTIS; GPO Dep.

The objectives of this supplement are to test an improved prototypic slug column displacement winch and associated remote control equipment and to demonstrate the feasibility of exerting control over the front-to-rear neutron flux changes as an aid in controlling reactivity cycling. An array of poison displacement columns up to twelve in number is intended, each charge consisting of a center section of I and E natural uranium slugs with mint pieces on each end. Initially six such columns will be charged with the remaining six being added later if required for proper control. The initial testing of the slug column displacement winch has established that the mechanics of the system are practicable and has indicated that the system would be feasible. The next phase of this test is to demonstrate the feasibility of controlling the front-to-rear flux changes over the entire reactor and to verify the improvement in equipment design. To be effective in controlling front-to-rear flux changes, there should be poison displacement tubes available in each quadrant of the reactor. It is believed that a maximum of twelve such tubes will be sufficient to show effective control with six of these being charged initially and the others added if required.

27676 (HW–62816) **Effects of 100-K water plant expansion on Panellits and orifices.** Stepnewski, D.D. General Electric Co., Richland, WA (United States). Hanford Atomic Products Operation. 2 Dec 1959. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE94016262. Source: OSTI; NTIS; GPO Dep.

The information reported here was requested by M.H. Schack, Facilities Engineering Operation. It pertains to the 100-K water plant expansion Project CG-775. In this project, cooling water pumping capacity will be increased from 178,000 GPM existing to 188,000 GPM and 200,000 GPM for five and six modified pumps respectively. Effects of increased through-put on process tube flow metering elements and on the reactor Panellit gauges have been examined. This information was required to determine cost of modifications if any were required. It was understood the precision of the cost estimate was to be about 40 percent. As a result of the increased process water flow through K reactor, no modifications are necessary to the orifices or venturis. The Panellits will require a mechanical adjustment. The need for such an adjustment already exists and the work has already been planned. If the maintenance proposal is approved, no expenditure of money for Panellits should be required in conjunction with the pump expansion. In some cases it appears that a TAI limit of 130 C may not be met by existing orifices with increased flow rates. However, in all these cases, the 130 C TAI limit could not be met by existing flow rates. From the standpoint of other orifice criteria checked, critical flow, minimum Panellit pressure on cap or pigtail failure, and velocity to cause erosion, the existing orifices and venturis appear adequate.

27677 (NUREG/CR–5908-Vol.1) **Advanced human-system interface design review guideline: General evaluation model, technical development, and guideline description.** O'Hara, J.M. Nuclear Regulatory Commission, Washington, DC (United States). Div. of Systems Research; Brookhaven National Lab., Upton, NY (United States). Jul 1994. 136p. Sponsored by Nuclear Regulatory Commission, Washington, DC (United States). (BNL-NUREG–52333-Vol.1). Source: OSTI; NTIS; INIS; GPO.

Advanced control rooms will use advanced human-system interface (HSI) technologies that may have significant implications for plant safety in that they will affect the operator's overall role in the system, the method of information presentation, and the ways in which operators interact with the system. The U.S. Nuclear Regulatory Commission (NRC) reviews the HSI aspects of control rooms to ensure that they are designed to good human factors engineering principles and that operator performance and reliability are appropriately supported to protect public health and safety. The principal guidance available to the NRC, however, was developed more than ten years ago, well before these technological changes. Accordingly, the human factors guidance needs to be updated to serve as the basis for NRC review of these advanced designs. The purpose of this project was to develop a general approach to advanced HSI review and the human factors guidelines to support NRC safety reviews of advanced systems. This two-volume report provides the results of the project. Volume I describes the development of the Advanced HSI Design Review Guideline (DRG) including (1) its theoretical and technical foundation, (2) a general model for the review of advanced HSIs, (3) guideline development in both hard-copy and computer-based versions, and (4) the tests and evaluations performed to develop and validate the DRG. Volume I also includes a discussion of the gaps in available guidance and a methodology for addressing them. Volume 2 provides the guidelines to be used for advanced HSI review and the procedures for their use.

27678 (NUREG/CR–5908-Vol.2) **Advanced human-system interface design review guideline: Evaluation procedures and guidelines for human factors engineering reviews.** O'Hara, J.M. (Brookhaven National Lab., Upton, NY (United States)); Brown, W.S.; Baker, C.C.; Welch, D.L.; Granda, T.M.; Vingelis, P.J. Nuclear Regulatory Commission, Washington, DC (United States). Div. of Systems Research; Brookhaven National Lab., Upton, NY (United States). Jul 1994. 275p. Sponsored by Nuclear Regulatory Commission, Washington, DC (United States). DOE Contract AC02-76CH00016. (BNL-NUREG–52333-Vol.2). Source: OSTI; NTIS; INIS; GPO.

Advanced control rooms will use advanced human-system interface (HSI) technologies that may have significant implications for plant safety in that they will affect the operator's overall role in the system, the method of information presentation, and the ways in which operators interact with the system. The U.S. Nuclear Regulatory Commission (NRC) reviews the HSI aspects of control rooms

to ensure that they are designed to good human factors engineering principles and that operator performance and reliability are appropriately supported to protect public health and safety. The principal guidance available to the NRC, however, was developed more than ten years ago, well before these technological changes. Accordingly, the human factors guidance needs to be updated to serve as the basis for NRC review of these advanced designs. The purpose of this project was to develop a general approach to advanced HSI review and the human factors guidelines to support. NRC safety reviews of advanced systems. This two-volume report provides the results of the project. Volume I describes the development of the Advanced HSI Design Review Guideline (DRG) including (1) its theoretical and technical foundation, (2) a general model for the review of advanced HSIs, (3) guideline development in both hard-copy and computer-based versions, and (4) the tests and evaluations performed to develop and validate the DRG. Volume I also includes a discussion of the gaps in available guidance and a methodology for addressing them. Volume 2 provides the guidelines to be used for advanced HSI review and the procedures for their use.

2205 Environmental Aspects

Refer also to citation(s) 27759, 28555

27679 (BNWL-CC–468) **Gamma spectrum, count rate, and dose rate measurements of the Columbia riverbank from Vernita to Sacajawea.** Grande, L.A. Pacific Northwest Lab., Richland, WA (United States). 31 Jan 1966. 17p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE94016931. Source: OSTI; NTIS; GPO Dep.

The purpose of this study was to evaluate radiological conditions that exist on the riverbank of the Columbia River. Included was a comparative study of the suitability of three instruments to measure the dose rates. These instruments were a NaI (T1) scintillation counter normally used for aerial monitoring, a bioplastic scintillation counter normally used as a road monitor, and a portable 40 liter ionization chamber normally used to measure very low gamma dose rates. The selection of representative sites for the comparative study was based on an initial GM survey of the general areas in question. Seven sites were studied–from Vernita Ferry Landing above the Hanford project to Sacajawea Park below Pasco.

27680 (DUN–959) **The Columbia River Cooling Program CY-1965.** Adachi, W.N.; Ballowe, J.W. Pacific Northwest Lab., Richland, WA (United States). 15 Apr 1966. 12p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE94016515. Source: OSTI; NTIS; GPO Dep.

The Columbia River Cooling Program basically consists of effecting a reduction in river temperature at the Hanford site during the summer season. The implementation of this program in recent years has been accomplished through the selective and controlled discharge of waste water at Grand Coulee Dam. The purpose of this report is to describe the river cooling program conducted in CY-1965 by Facilities Engineering personnel, and present the program results.

27681 (PNL–9980) **Chernobyl nuclear accident hydrologic analysis and emergency evaluation of radionuclide distributions in the Dnieper River, Ukraine, during the 1993 summer flood.** Voitsekhovitch, O.V. (Ukrainian Hydrometeorological Inst., Kiev (Ukraine)); Zheleznyak, M.J.; Onishi, Y. Pacific Northwest Lab., Richland, WA (United States). Jun 1994. 121p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE94015596. Source: OSTI; NTIS; INIS; GPO Dep.

This report describes joint activities of Program 7.1.F, "Radionuclide Transport in Water and Soil Systems," of the USA/Commonwealth of Independent States (CIS) Joint Coordinating Committee of Civilian Nuclear Reactor Safety to study the hydrogeochemical behavior of radionuclides released to the Pripyat and Dnieper rivers from the Chernobyl Nuclear Power Plant in Ukraine. These joint activities included rapid evaluation of radionuclide distributions in the Pripyat and Dnieper river system and field data evaluation and modeling for the 1993 summer flood to assist the Ukrainian government in their emergency response during the flood. In July-August 1993, heavy rainfall over the Pripyat River Catchment in Belarus and Ukraine caused severe flooding, significantly raising ^{90}Sr concentrations in the river. Near the Chernobyl area, the maximum ^{90}Sr concentration in the Pripyat River reached 20–25 PCi/L in early August; near the Pripyat River mouth, the concentration rose to 35 pCi/L. The peak ^{90}Sr concentration in the Kiev Reservoir (a major source of drinking water for Kiev) was 12 pCi/L. Based on these measured radionuclide levels, additional modeling results and the assumption of water purification in a water treatment station, ^{90}Sr concentrations in Kiev's drinking water were estimated to be less than 8 pCi/L. Unlike ^{90}Sr, ^{137}Cs concentrations in the Pripyat River during the flood did not rise significantly to the pre-flood levels. Estimated ^{137}Cs concentrations for the Kiev drinking water were two orders of magnitude lower than the drinking water standard of 500 pCi/L for ^{137}Cs.

27682 (STUK/YVL-GUIDE–7.1) **Limitation of public exposure in the environment of and limitation of radioactive releases from nuclear power plants.** Finnish Centre for Radiation and Nuclear Safety (STUK), Helsinki (Finland). 1993. 9p. Translation of the original text in Finnish which published under the same guide number. Order Number DE94632359. Source: OSTI; NTIS; INIS.

The guide is valid from 1 January 1993 and will remain in force until further notice. It replaces the guide YVL 7.1 issued on 7 October 1987.

In Finland, the general regulations for the limitation of the radiation exposure are defined in the Finnish Radiation Act (592/9) and Degree (1512/91). This guide specifies the requirements for the limitation of the public exposure in the environment of the nuclear power plants. The limits for the dose of an individual of the population arising from the normal operation of a nuclear power plant and as the result of an anticipated operational transient, as well as the dose limits arising as the result of a postulated accident or severe reactor accidents are given. Also the release limits during the normal operation of a nuclear power plant and releases requiring action are given. (4 refs.).

2206 Research, Test, Training, Production, Irradiation, Materials Testing Reactors

Refer also to citation(s) 27267, 27270, 27523, 27532, 27533, 27534, 27563, 27568, 27659, 27672, 27673, 27674, 27675, 27678, 27768, 27769, 27770, 27772, 27779, 27780, 27781, 27782, 27783, 27784, 27785, 27786, 27787, 27788, 27914

27683 (ANL/RERTR/TM–1) **Reduced enrichment for research and test reactors: Proceedings.** Argonne National Lab., IL (United States). Aug 1993. 227p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-781151–: International meeting on advance fuel fabricators technology for research and test reactors, Argonne, IL (United States), 9-10 Nov 1978). Order Number DE94014936. Source: OSTI; NTIS; INIS; GPO Dep.

November 9–10, 1978, marked the first of what has become an annual event–the International Meeting on Reduced Enrichment for Research and Test Reactors (RERTR). The meeting brought together for the first time many people who became major program participants in later years. This first meeting emphasized fuel development, and it established the basis for all later meetings. Believing that the proceedings of this first meeting are important as a historical record of the beginning of the international RERTR effort. This report provides presentations and discussions of this original meeting. Individual papers have been cataloged separately.

27684 (DPW–53-1355) **Process development programs.** Squires, L. Du Pont de Nemours (E.I.) and Co., Wilmington, DE (United States). Explosives Dept. 5 Nov 1953. 17p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-76SR00001. (SR/H–722). Order Number DE94011766. Source: OSTI; NTIS (US Sales Only); GPO Dep.

Process development programs at the Savannah River plant, November, 1953, are out-lined. Specific areas of discussion include: the 100 area(production Reactors), the 200 area, and the 300 area.

27685 (DUN–1838-RD) **Sample calculation – GVR values for determining tritium separations costs.** Bown, R.W. Douglas United Nuclear, Inc., Richland, WA (United States). 12 Dec 1966. 2p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE94015113. Source: OSTI; NTIS; GPO Dep.

This paper shows the calculations for the Gas Volume Ratio, defined as the Total Gas Volume/Target Volume. Using 20 tons of $LiAlO_2$ as the target, 5028 cubic feet of tritium, protium, and helium are produced. The target volume equals 312.5 cubic feet of aluminate, so that the GVR = 5028/312.5 = 16.1.

27686 (DUN–3333-Del.) **Lithium-aluminum separations request.** Ambrose, T.W. Douglas United Nuclear, Inc., Richland, WA (United States). 10 Nov 1967. 2p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE94015677. Source: OSTI; NTIS; GPO Dep.

A test irradiation of lithium was recently completed in one of the Hanford K Reactors. It is requested that these lithium-aluminum alloy targets be separated and analyzed for tritium content. This request is for the analysis to be performed on two groups or batches of samples. The first group would be 38 elements with a total gas content estimated to be approximately 97 liters. The second batch would consist of 76 elements with a total gas content estimated to be approximately 193 liters. This then would be followed by an analysis of the combined gas content of both batches.

27687 (DUN–4745-Del.) **Carbon-14 extraction from reactor gas, Progress report: Production test authorization #124.** Cooke, J.P. Douglas United Nuclear, Inc., Richland, WA (United States). 24 Jan 1969. 18p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE94015118. Source: OSTI; NTIS; GPO Dep.

Carbon-14 is by far the most popular of the labeled isotopes because of its adaptability to so many chemical compounds and its relatively harmless characteristic beta radiation. Because the inert gas atmosphere contains up to 30% nitrogen, carbon-14 is generated within the K Reactors by the conversion of nitrogen-14, and if not immediately oxidized, carbon-14 may remain in the reactor core for some time. It is eventually oxidized and escapes when the outward gas leakage from the reactor is vented to the stack. Production Test 124 was authorized to determine if carbon-14 could be extracted from the K gas as a profitable by-product. It was concluded that as much as 500–600 curies per year of carbon-14 could be recovered if both K Reactors were provided with relatively simple extraction facilities. This is about twice the amount of this product for which there is a current market at the present price level of approximately $3,000/curie. The grade (as specific activity) of the product recovered in the production test was low – ranging from 3 to 26 millicuries per mol. Substantial upgrading (perhaps by a factor of 10X to 100X) is possible by skimming techniques and reduced oxidation of normal carbon at Hanford, but economic parameters of upgrading vs total production rates will require additional market volume and price data. Two further methods of upgrading the product after it leaves Hanford are discussed briefly.

27688 (ECN-I–93-026) **Neutron Metrology in the HFR. Steel irradiation experiment T139-662.** Polle, A.N.; Voorbraak, W.P. Netherlands Energy Research Foundation (ECN), Petten (Netherlands). Sep 1993. 46p. Project Number ECN 1653.01. Order Number DE94789642. Source: OSTI; NTIS; INIS.

The irradiation experiment R139-66 is part of a research program to determine the post-irradiation mechanical properties of different types of stainless steel, i.e. ERHI and ERHII. The irradiation circumstances for this experiment, carried out in a REFA type capsule in HFR position E3, represent the conditions at the first wall of NET (Next European Torus). The report presents the final neutron metrology results obtained from activation monitors in the specimen holder, coded as R139-662. Data about the helium production as well as the number of displacements per atom are also included. The main results of the thermal and fast neutron fluence measurements are presented. (orig./HP)

27689 (ECN-I–93-027) **Neutron metrology in the HFR. Steel irradiation experiment R139-663.** Polle, A.N.; Voorbraak, W.P. Netherlands Energy Research Foundation (ECN), Petten (Netherlands). Sep 1993. 48p. Project Number ECN 1653.01. Order Number DE94789641. Source: OSTI; NTIS; INIS.

The irradiation experiment R139-663 is part of a material test program to test the mechanical properties of different types of stainless steel, i.e. ERHI, ERHII and AISI 316 TIG weld material. The irradiation circumstances for this experiment, carried out in a REFA type capsule in HFR position E3, represent the conditions at the first wall of NET (Next European Torus). This report presents the final neutron metrology results obtained from activation monitors in the specimen holder, coded as R139-663. Data about the helium production as well as the number of displacements per atom are also included. The main results of the thermal and fast neutron fluence measurements are presented. (orig./HP)

27690 (ECN-I–93-035) **Neutron metrology in the HFR. Steel irradiation: Experiment R139-664.** Ketema, D.J.; Voorbraak, W.P. Netherlands Energy Research Foundation (ECN), Petten (Netherlands). Dec 1993. 47p. Project Number ECN 1653.01. Order Number DE94789660. Source: OSTI; NTIS; INIS.

The experiment series R139-66, for testing the mechanical properties of different types of stainless steel (i.e. ERHI, ERHII and AISI 316 TIG), has been irradiated in the HFR Petten. This report presents the final metrology results obtained from activation monitors in the specimen holder, coded as R139-664. Data about the helium production as well as the number of displacements per atom are also included. The irradiation conditions for this experiment, carried out in a REFA type capsule in HFR positin E7, are as close as possible relevant for the conditions of the candidate materials which will be used for the first wall of the NET (Next European Torus). The main results of the thermal and fast neutron fluence measurements are presented. (orig.)

27691 (ECN-I–94-002) **Neutron metrology in the HFR. Steel irradiation: R139-692/693.** Ketema, D.J.; Voorbraak, W.P. Netherlands Energy Research Foundation (ECN), Petten (Netherlands). Apr 1994. 37p. Project Number ECN 1652.01. Order Number DE94789662. Source: OSTI; NTIS; INIS.

The experiment R139-69, for testing the stainless steel type 316-L, has been irradiated in the HFR Petten. This report presents the final metrology results obtained from activation monitors in the specimen holders, coded as R139-692/693. Data about the helium production as well as the number of displacements per atom are also included. The irradiation conditions for this experiment, carried out in a TRIO type capsule in HFR position F8, are as close as possible relevant for the candidate materia which will be used for the first wall of the NET (Next European Torus). The main results of the thermal and fast neutron fluence measurements are presented. (orig.)

27692 (ECN-I–94-010) **Experiments ILAS I, II and III: Nuclear analysis and activity calculations.** Freudenreich, W.E. Netherlands Energy Research Foundation (ECN), Petten (Netherlands). Feb 1994. 31p. Order Number DE94785928. Source: OSTI; NTIS; INIS.

In the irradiation experiments ILAS I, II, and III different reduced activation (RA) and low activation (LA) steels will be irradiated up to 2.5 dpa. The results of the calculation of the nuclear constants, the reactivity effect, and the activity of the sample holder and the different steel samples are presented. (orig.)

27693 (ECN-I–94-011) **Neutron metrology in the HFR. Irradition of vanadium alloys. Experiment R204-7/8/9 (VABONA).** Polle, A.N.; Voorbraak, W.P. Netherlands Energy Research Foundation (ECN), Petten (Netherlands). Mar 1994. 35p. Order Number DE94789661. Source: OSTI; NTIS; INIS.

The irradiation experiment R204-7/8/9 is part of a material research program VABONA in which the radiation damage is investigated of different vanadium alloys. The experiment deals with the irradiation of vanadium specimens α-implanted at the cyclotron in Ispra. The irradiation has been performed in a SIENA capsule in

the HFR Petten at three different temperatures (873, 973 and 1073 K). The irradiation took place in position C5 during seven HFR operating cycles. The target damage level was 5 dpa (displacements per atom). This report presents the final neutron metrology results obtained from activation monitors in the three specimen holders, coded as R204-7/8/9. Data about the number of displacements per atom are also included. The main results of the thermal and fast neutron fluence measurements are presented. (orig.)

27694 (ECN-I–94-014) **Experiment CATETO I: Nuclear analysis and activity calculations.** Hendriks, J.A.; Freudenreich, W.E. Netherlands Energy Research Foundation (ECN), Petten (Netherlands). Mar 1994. 19p. Project Number ECN 1660.01. Order Number DE94785927. Source: OSTI; NTIS; INIS.

In the irradiation experiment CATETO I reduced activation (RA) steel will be irradiated up to 1.5 dpa at a temperature of 300 C. The results of the calculation of the nuclear constants, the reactivity effect, and the activity of the steel samples are reported. (orig.)

27695 (ECN-I–94-015) **Experiment CATETO II: Nuclear analysis and activity calculations.** Hendriks, J.A.; Freudenreich, W.E. Netherlands Energy Research Foundation (ECN), Petten (Netherlands). Mar 1994. 25p. Project Number ECN 1660.01. Order Number DE94785926. Source: OSTI; NTIS; INIS.

In the irradiation experiment CATETO II different reduced activation (RA) steels will be irradiated up to 2.5 dpa at a temperature of 300 C. The results of the calculation of the nuclear constants, the reactivity effect, and the activity of the steel samples are presented. (orig.)

27696 (EGG–1183-1022) **EG&G Rover progress report for 1-31 January 1964: Report No. L-64.** Edgerton, Germeshausen and Grier, Inc., Bedford, MA (United States). 15 Feb 1964. 49p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC08-76NV01183. Order Number DE94014957. Source: OSTI; NTIS; GPO Dep.

This report describes EG&G activities in support of the Rover Program for the month of January, 1964. Details are discussed in succeeding sections and in the appendices with respect to the various tasks included in our scope of work. At Test Cell A., the Facility Mapping Test, EP-IV, was success- fully completed. Preparation continued for the NRX-AL program scheduled for February, 1964. At Test Cell C., a high flow acoustics test, EP- 1, was conducted. This was the last experimental plan to be completed before the Kiwi-B4D cold flow test series, scheduled to begin on 31 January 1964. Cost curves, except for Test Cell C Operations, still are somewhat below the budget.

27697 (ERA-NRE–94-016) **Measured thermal and fast neutron fluence rates, ATR Cycle 102-A, 11/28/93 thru 1/16/94.** Murray, R.K.; Rogers, J.W. EG and G Idaho, Inc., Idaho Falls, ID (United States). Feb 1994. 54p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE94015252. Source: OSTI; NTIS; INIS; GPO Dep.

This report contains the thermal (2,200 m/s) and fast (E > 1MeV) neutron fluence rate data for ATR Cycle 102-A which were measured by the Radiation Measurements Laboratory (RML) as requested by the Power Reactor Programs (ATR Experiments) Radiation Measurements Work Order. This report contains fluence rate values corresponding to the particular elevations (relative to the 80 ft. core elevation) where the measurements were taken. The data in this report consists of (1) a table of the ATR power history and distribution, (2) a hard copy listing of all thermal and fast neutron fluence rates, (3) plots of both the thermal and fast neutron fluence rates, and (4) a magnetic record (3.5 inch diskette) containing a listing of only the fast neutron fluence rates, their assigned elevations and proper header identification of all monitor positions contained herein. The fluence rates reported are for the average power levels given in the table of power history and distribution. All "H" holder monitoring wires for this cycle are 54 inches long. All "SR" holder monitor wires for this cycle are 55 inches long. This length allows measurement of the full core region and makes the first count elevation 24.73 inches above core midplane. Due to the safety rod problems in the west lobe, "BR" holders were used in the W-1, 2, 3, and 4 positions. All "BR" holder monitor wires for this cycle are 56.25 inches long. The distance from the end of the wires to the first count position was 4.25 inches for all wires counted from this cycle.

27698 (HW–57168-F) **Section 3 reactor statistics: April 1961–May 15, 1962.** Burke, R.C. General Electric Co., Richland, WA (United States). Hanford Atomic Products Operation. 13 Jun 1962. 39p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE94015428. Source: OSTI; NTIS; GPO Dep.

This discussion and summary report illustrate the type of information that is in data processing machine language and available to those who require it. The reports are comprised of three major sections. The first is a map indicating the number of recordings of data in the category defined by the function number code. The second is a summary of the data, in term of hours, for each of the functions performed during an outage, except secondary function code number 21 which is the number of tubes associated with the basic function performed. The third is a summary of the secondary functions performed with a basic function class, the associated delay total and the number of tubes involved for those functions where a delineation by tube count may be of interest.

27699 (HW–57168-G) **Reactor statistics - Section III, April 1961 - May 15, 1962.** Burke, R.C. Pacific Northwest Lab., Richland, WA (United States). 13 Jun 1962. 38p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE94017016. Source: OSTI; NTIS; GPO Dep.

This report is a summary of the way information is stored on the maintenance histories of the Hanford Production Reactors. Twenty two different categories are considered as primary reasons for maintenance down times. The data is stored in terms of hours spent on different tasks, and is also grouped by the controlling cause of the outage.

27700 (HW–58946) **Irradiation program for candidate 105-N graphites.** Woodruff, E.M. General Electric Co., Richland, WA (United States). Hanford Atomic Products Operation. 20 Jan 1959. 13p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE94015697. Source: OSTI; NTIS; GPO Dep.

Selection of new graphites for nuclear reactor moderator applications can be accomplished either by: (1) an evaluation of the behavior of untested materials processed by proven methods of manufacture when tested under conditions typical of the proposed application, or, (2) a development program exploring new materials, processes and environments which results in graphites meeting or exceeding design requirements. The latter approach is not easily adapted to construction schedules and therefore can at this date contribute little to the 105-N program. The program for selecting 105-N reactor graphite is governed basically by two factors: dimensional stability of graphite under the proposed operating conditions is the major design requirement to be met and the types of petroleum coke and processes used in manufacturing artificial graphites directly influence their behavior under irradiation. Since the evaluation and procurement of graphite for the 100-K reactors, carbon companies have established a number of new coke sources. Some major changes in processing graphite have also been developed; however, these have not reached full production scale and cannot be considered sources for 105-N graphite. Consequently, candidate graphites for the 105-N reactor are those representing the new coke sources plus Texas Lockport coke, the only previously evaluated coke now available, processed with only minor variation of methods used in the past. The program for irradiation testing these graphites is presented here to indicate its capabilities and limitations in providing information for the selection of 105-N graphite. Graphite irradiations supporting present Hanford operations and the development of graphites for future applications are included to indicate total utilization of the available irradiation facilities.

27701 (HW–60039) **Defect testing of coextruded uranium-zircaloy-II clad fuel material in a 300 C out-of-reactor recirculating water loop: interim report.** Hayden, K.D.; Goffard, J.W. General Electric Co., Richland, WA (United States). Hanford Atomic Products Operation. 25 Sep 1959. 32p. Sponsored by

USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE94015693. Source: OSTI; NTIS; GPO Dep.

A major problem in the development of a pressurized water reactor coolant system for the NPS is the rupture performance of the fuel elements. As water temperatures are increased to 300 C, uranium corrosion rates increase rapidly. Swelling of the uranium fuel by corrosion could cause the process tube to burst or reduce the tube cooling water flow below acceptable limits. The desirability of slow cooling of the water to avoid thermal shocks to the reactor piping after a rupture is detected further complicates discharge and decontamination problems as fuel will continue to corrode with attendant fuel element damage during the cooling period. Coextruded uranium-zircaloy-2 clad fuel elements are scheduled for use in the NPR. The rupture behavior of this type fuel material after heat treatment was studied in ELMO-4, an out-of-reactor recirculating water loop. Several types of initial defects were studied. Fuel materials with five different heat treatment histories and with different types of defects were tested to determine their rupture behaviors. The five conditions were (1) as-extruded material as received from Nuclear Metals, Inc., (2) beta heat-treated and water quenched, (3) beta heat-treated and air-cooled, (4) beta heat-treated, isothermally treated at 600 C and air-cooled, and (5) beta heat-treated and furnace cooled (vacuum). Both pinhole and cleavage type defects were studied. Most of the work consisted of measuring weight loss and physical dimension changes after various lengths of exposure in 300 C water. This report presents the results of the tests.

27702 (HW–60439) **Operational reactivity accounting by one-group theory.** Parkos, G.R. General Electric Co., Richland, WA (United States). Hanford Atomic Products Operation. 18 Jun 1959. 33p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE94015676. Source: OSTI; NTIS; GPO Dep.

The reactivity accounting and calculating techniques currently used in operational physics work are almost entirely based upon the flux squared weighting theorem. This theorem has some very serious limitations as the flattening of the reactors is increased. As a consequence many of the calculating techniques and results are theoretically unsound. Unexplainable discrepancies from pile to pile, and in reactivity data compared to original startup data and lattice physics measurements have been noted in the past. This report describes a method of reactivity evaluation based upon a one-group diffusion theory and a multi-region cylindrical geometry approximation. Results are presented which indicate that the methods outlined provide satisfactory accuracy. It is recommended that the methods outlined be adopted for routine reactivity evaluations as soon as the necessary machine computations have been made and standard procedures have been developed. Specific recommendations and results will be published as supplements to this report as soon as data are available.

27703 (HW–60520) **Irradiation performance of coextruded enriched uranium fuel rod PT-IP-A172-A: Final report.** Claudson, T.T. General Electric Co., Richland, WA (United States). Hanford Atomic Products Operation. 26 May 1959. 19p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE94015699. Source: OSTI; NTIS; GPO Dep.

The proposed operating conditions for fuel elements to be charged into the NPR require the fuel to be of an extended surface geometry and maintain adequate strength and corrosion resistance in 300 C water. A contract was let to Nuclear Metals Inc. to produce by co-extrusion lengths of fuel rod containing both natural and 1.6% enriched uranium of irradiation quality for fabrication into fuel elements. The fuel rods used in the irradiation test represent the first enriched uranium rods coextruded in 0.030 inches of Zircaloy-2 to be irradiated and examined at Hanford. The rods used for this test were fabricated into four, 4 rod cluster fuel elements thus allowing adequate space between individual rods for expansion in the case of a fuel rod failure. This rod was of particular interest since it contained an irregular uranium-Zircaloy-2 interface. The purpose of the irradiation was to determine the dimensional stability of coextruded fuel rods and to determine whether the irregularity in the bond interface had any effect upon the irradiation performance of the fuel. Fuel elements were irradiated in 200 C water in the KER Loop 2 facility to an exposure of 0.28 a/o burnup (2,200 MWD/T). Post irradiation examination showed that each rod had increased an average of 0.008 inches in outside diameter and that macrocracks had formed throughout the uranium core. The uranium had also increased in length to fill 0.050 inch of space left between the end cap and uranium for thermal expansion and uranium growth. A metallurgical bond between the end cap and the uranium had been formed during the irradiation. There was no effect of the irregular interface on the dimensional stability of the fuel rods.

27704 (HW–60810) **Xenon calculations for I and E fuel element.** Chitwood, R.A. General Electric Co., Richland, WA (United States). Hanford Atomic Products Operation. 2 Jul 1959. 29p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE94016403. Source: OSTI; NTIS; GPO Dep.

This document describes in detail the calculations that are basic to the xenon problem. While much of this work appears elsewhere, herein an attempt has been made to bring it together and make it as understandable as possible. The principle purpose of this document is to calculate the equilibrium xenon poisoning for the I and E geometry fuel element and compare the results to the equilibrium xenon poisoning for the solid geometry fuel element. Further objectives are to provide an understandable reference for those with interest in the basic xenon formulation, and to serve as a training guide for new personnel.

27705 (HW–61767) **In-reactor measurement of fuel element cladding temperatures.** Doman, D.R. General Electric Co., Richland, WA (United States). Hanford Atomic Products Operation. 8 Apr 1960. 43p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE94015691. Source: OSTI; NTIS; GPO Dep.

A design was developed for leading thermocouples from a high-temperature, pressurized water reactor-coolant system of such integrity that no reactor shutdowns were caused by its use. Using this design, measurements of the fuel-element-cladding temperature and its variation with time were made in three tests on elements clad in type X-8001 aluminum alloy. The following conclusions were reached from the test results: (1) the cladding temperature of a fuel element operated at low heat flux in high bulk-outlet temperature water did not increase with time and was slightly lower than predicted by the Sieder-Tate equation; (2) cladding temperatures of fuel elements operated at high heat flux in either high bulk-inlet or outlet temperature water increased 40 C higher than predicted by the Sieder-Tate equation with initial temperatures equal to the predicted temperatures; and (3) the rate of temperature increase appeared dependent only on fuel-element heat flux and location with respect to the front and rear faces of the reactor.

27706 (HW–61928) **Effects of fuel element heat capacity on reactor outlet temperatures following flow reduction or power surges.** Hesson, G.M.; Moulton, R.W. Battelle, Columbus, OH (United States). 15 Sep 1959. 12p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE94016397. Source: OSTI; NTIS; GPO Dep.

The purpose of this report is to present a semi-quantitative discussion of the effect of the heat capacity of the process tube assembly on the outlet water temperature following a mild inadequate cooling incident involving an entire reactor.

27707 (HW–61955) **Production test IP-285-C measurement of operating temperatures of uncooled thermal shield cooling tube.** Smalley, W.L. General Electric Co., Richland, WA (United States). Hanford Atomic Products Operation. 21 Sep 1959. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE94016274. Source: OSTI; NTIS; GPO Dep.

The purpose of this test is to obtain data that may be used as a basis for revising certain Process Standards applying to the cooling or existing reactor shields. The data may also be useful in connection with NPR thermal shield design work. The fact that one of the H reactor bottom thermal shield cooling tubes presently has a flow blockage makes possible an immediate opportunity for test data

without undue risk other than that already encountered. Procedures, costs, and hazards of the test are given.

27708 (HW–61995) **Specifications: Laboratory hot press process for "C"size I & E fuel elements.** Tverberg, J.C. Battelle, Columbus, OH (United States). 25 Sep 1959. 40p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE94015967. Source: OSTI; NTIS; GPO Dep.

Hot press canning of internally and externally cooled fuel elements has been developed to a point where the process is feasible. Complete specifications have been written for the process covering component, dies and punches, furnace construction, nickel plating, component cleaning, component assembly, sizing, hot pressing and inspection. Drawings covering each major item are included.

27709 (HW–62651-1) **Net return course - operational severity index formuli.** Battelle, Columbus, OH (United States). 28 Dec 1959. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE94016267. Source: OSTI; NTIS; GPO Dep.

This document presents a nomograph from which the relationship between reactor operating parameters, tube power, and outlet temperature can be correlated with rupture rate. The index indicates the severity of the reactor climate during irradiation and does not include the metal quality parameters defined in the rupture rate equation. The general form of the Operational Severity Index Equation is $OSI=P^{3.3}/1000\times t_0^{8.7}/100$, where OSI, is the unitless Operational Severity Index, P is the tube power in kW, and t_0 is the tube outlet temperature, in degrees C.

27710 (HW–64793-RD) **Engineering bases for power levels and exposures - April, 1960, thru December, 1960.** Graves, S.M. Battelle, Columbus, OH (United States). 28 Apr 1960. 23p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE94016401. Source: OSTI; NTIS; GPO Dep.

It is the purpose of this document to provide assistance to the Manufacturing Section personnel in determining their future operating plans. In general, the inter-relationship of such engineering parameters as flow, reactor orificing, rupture performance, etc. has been considered. The effect of these engineering parameters are summed up in our recommendations for "Operating Plans" shown graphically in this document. It is to be emphasized that these plans do not reflect operational considerations which may modify the desirability of the indicated level increases nor has allowance been made for ability of the indicated level increases nor has allowance been made for major projects, major maintenance outages, or major changes in pile loadings. Many factor, which only Manufacturing personnel are capable of evaluating, may make it desirable to operate below or above these "Operating Plans." These "plans" are based on incremental metal cost and burnout cost estimates obtained recently from L. W. Lang. A change in these assumed costs would require a revision to be made to these "plans." It is also to be noted that many of the engineering parameters and basic assumptions which have been factored into these "plans" are subject to continual re-evaluation and revision. Thus, in a strict sense, these "plans" are outdated even as they are published. However, their value will lie primarily in illustrating the approximate conditions under which each reactor can be operating for the balance of CY-1960; thus, permitting some perspective of individual and collective reactor operation. Process Engineering will continue to make specific power level or operational severity recommendations on a current basis as changes in engineering parameters, i.e., rupture performance, flow and loading consideration, safety limits, etc. dictate.

27711 (HW–71233) **Rear face piping study at elevated bulk outlet temperatures KE Reactor.** Frieling, D.H.; Hutton, P.H. General Electric Co., Richland, WA (United States). Hanford Atomic Products Operation. 9 Nov 1961. 12p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE94015219. Source: OSTI; NTIS; GPO Dep.

Accumulation of data on rear face piping strain, piping vibration, water pressures; and water temperatures at KE Reactor was recently completed. A preliminary review of this data indicates that much of the pressure and temperature data could be significant to the study regarding the capability of the K Reactor rear face piping to accommodate the proposed increased water flow. In view of this, a copy of the pressure-temperature data is attached. The purpose of the test was two-fold: (1) to establish mechanical and hydraulic conditions in the rear face piping accompanying operation at current flows and maximum bulk outlet temperatures; (2) to use this information to assess the feasibility of continued operation at these conditions. A preliminary review of the data brings forth the following observations: (1) a downcomer flow transition begins to occur at about the 85 C bulk outlet temperature; (2) the current flow conditions at the top of the downcomer appear to be slightly different from the original design concept; (3) the pressure recorded on the near side of the downcomer just above the orifice (P-10) appears doubtful, and instrumentation will be checked; (4) flow characteristics of the multiple parallel orifices in a single channel does not appear to be as initially anticipated; additional information regarding this phenomena is needed.

27712 (HW–72371) **K reactor inlet assembly cavitation study header venturi versus nozzle venturi.** Kelley, L.R. General Electric Co., Richland, WA (United States). Hanford Atomic Products Operation. 22 Jan 1962. 21p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE94010490. Source: OSTI; NTIS; GPO Dep.

Delassified.

This document describes the development and test of a short nozzle-mounted venturi. The development's purpose was to permit the elimination of cavitation collapse in a reactor inlet pigtail during flush discharge.

27713 (HW–74305) **Production test IP-520-A in-reactor testing with coolant prepared in the water treatment pilot plant.** Geier, R.G. Battelle, Columbus, OH (United States). 16 Jul 1962. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE94016277. Source: OSTI; NTIS; GPO Dep.

The objective of this test are: (1) to operate two single pass tubes in the 1706-KE in-reactor facility using water treated in the water treatment pilot plant, (2) to obtain samples of effluent water, and (3) to obtain corrosion measurements from weighed fuel, dummies, and coupons.

27714 (HW–79734) **Long-term neutron activation products of nickel-58.** Morgan, W.C. General Electric Co., Richland, WA (United States). Hanford Atomic Products Operation. 11 Dec 1963. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE94016399. Source: OSTI; NTIS; GPO Dep.

Certain advantages, such as higher strength at elevated temperature, have led to the use of alloys containing large percentages of nickel as a replacement for aluminum components. One example is the Inconel sheathing of control rods for the Hanford reactors. Since some of these components may remain in a reactor several years prior to removal, the neutron-activation products resulting from multiple chain reactions may become important in determining the radiation exposure levels at discharge. This paper outlines one of the activation chains which may contribute significantly to the γ-activity. Equations are developed from which the concentrations of the product isotopes emanating from nickel-58 can be calculated. "Best values" of the parameters used in these calculations are tabulated, and the conversion from isotope concentration to γ-dose rate is outlined.

27715 (HW–79808) **Production test IP-638-D, operation of KER-1 -2, -3, and -4 simulating N reactor conditions December 5, 1963.** Neidner, R. Battelle, Columbus, OH (United States). 5 Dec 1963. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE94016400. Source: OSTI; NTIS; GPO Dep.

The objective of this production tests is to irradiate N Reactor prototype and candidate fuel components and alternate products at simulated N-Reactor pressure and temperature conditions in KER Loops 1, 2, 3, and 4.

27716 (HW–82789) **Production test IP-695-AC thorium oxide irradiation – K Reactors.** Gross, P.D.; Hladek, K.L. General Electric Co., Richland, WA (United States). Hanford Atomic Products Operation. 7 Jul 1964. 17p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE94016438. Source: OSTI; NTIS; GPO Dep.

Irradiation of thorium for the production of "clean" U-233 at HAPO began in CY 1963. Several small-scale tests, involving from gram-size quantities up to a few elements, were successfully conducted; the results from these tests, coupled with theoretical predictions, indicated the desirability of further investigation. The objectives of this test are to (1) authorize the irradiation of about two tons of thorium oxide target elements in central zone process tubes of KE Reactor, (2) determine the reactivity effects of an enriched uranium-thorium oxide (E-Q) loading in the K Reactors, (3) demonstrate the feasibility of using the K Reactors in production of "clean" U-233, (4) provide sufficient irradiated thoria material to permit demonstration of the chemical processing capabilities, and (5) obtain data from an extended irradiation of one column of thoria elements.

27717 (HW–82977-RD-4) **IPD production projections.** Lang, L.W. Battelle, Columbus, OH (United States). 4 Aug 1964. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE94015963. Source: OSTI; NTIS; GPO Dep.

This document reports the IPD production projections and reactor inventories for Hanford C and K reactors. Tables included contains the following information: Operating efficiency, exposure, conversion ratio, tonnage, production, and power level.

27718 (HW–83318) **Reactor operations daily report form BM-5000-052 (7-64).** DeNeal, D.L. Pacific Northwest Lab., Richland, WA (United States). 17 Jul 1964. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE94017242. Source: OSTI; NTIS; GPO Dep.

This document is a summary of the new Reactor Operations Daily Report, which is to be implemented August 3, 1964. The report explains how the form is to be filled out, and what information is to be entered into the different fields on the form.

27719 (HW–83367) **N-Reactor shutdown for fuel rupture indications - tube 3361.** Renberger, D.L. Pacific Northwest Lab., Richland, WA (United States). 31 Jul 1964. 12p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE94017234. Source: OSTI; NTIS; GPO Dep.

The N-Reactor was shutdown on July 7, 1964, due to fuel rupture indications on tube 3361. The rupture has been confirmed as a failure in the downstream inner fuel element in tube 3361 caused by a pin hole in the weld and braze metal. This document presents a historical record of the rupture indications observed prior to and following the shutdown. The operating history of tube 3361 is compared with an adjacent tube, with no abnormal conditions observed at any time. Reactor temperature and power history since initial primary loop heatup are presented to show the total operating history experienced by N-Reactor.

27720 (HWN–1697) **Personal notes [of D.S. Lewis, 7 September 1956 to 31 December 1959].** Lewis, D.S. General Electric Co., Richland, WA (United States). Hanford Atomic Products Operation. 7 Sep 1956. 82p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE94016504. Source: OSTI; NTIS; GPO Dep.

This report is a copy of the personal log of D.S. Lewis of the Irradiation Processing Dept. of Reactor Operations at Hanford and covers the period from 7 September 1956 through 31 December 1959. Data are presented on the following: (1) basic reactor operating data, including daily operating data, outage resumes, injuries and incidents, charging and tube replacement rates, panellit gage (flowmeter) trip failures, and thermocouple failures, and (2) basic reactor information on the water plant, electrical distribution, VSR's, HCR's, Ball 3X, Safety circuits, gas system, effluent system, process tube cross-section, and production scheduling.

27721 (INIS-JP–020, pp. 3-10) **Status report on the Indonesian multipurpose reactor, RSG-GAS.** Arbie, B. (Badan Tenaga Atom National (BATAN), Jakarta (Indonesia)); Supadi, S. Japan Atomic Energy Research Inst., Tokyo (Japan). 1994. 359p. (CONF-9309370–: IGORR-III: 3. meeting of the international group on research reactors, Naka (Japan), 30 Sep - 1 oct 1993). In *Proceedings of the third meeting of the international group on research reactors (IGORR-III).* Order Number DE94765352. Source: OSTI; NTIS; INIS.

RSG-GAS, a 30 MW multipurpose reactor, and located at Serpong Atomic Energy Research Center, went to its first criticality on July 29, 1987. Its nominal power was just achieved in March, 1992 by operating the full core configuration (core-VI) after successive five transition core commissioning operation. By then, the reactor performed as expected to produce thermal neutron flux in the order of 10^{14} n/(cm^2.sec) safely to support research, radioisotope production as well as material testing including man power development. The long commissioning activities and experiences are outlined in the paper. Main characteristics of the reactor is also presented. Nowadays, the reactor is operating at core no. 9, in weekly modes, mainly for radioisotope production. Some facilities for neutronic experiment, material and fuel testing are being commissioned. Study of silicide fuels to replace the oxide ones is in progress. Several silicide fuel elements with similar specification to the existing oxide fuels have been inserted in the core since 1989. In five years, the RSG-GAS is expected to operate with the silicide fuel. (author).

27722 (INIS-JP–020, pp. 11-46) **Studsvik's R2 reactor-review of activities.** Grounes, M. (Studsvik Nuclear, Nykoeping (Sweden)); Tomani, H.; Graeslund, C.; Rundquist, H.; Skoeld, K. Japan Atomic Energy Research Inst., Tokyo (Japan). 1994. 359p. (CONF-9309370–: IGORR-III: 3. meeting of the international group on research reactors, Naka (Japan), 30 Sep - 1 oct 1993). In *Proceedings of the third meeting of the international group on research reactors (IGORR-III).* Order Number DE94765352. Source: OSTI; NTIS; INIS.

A general description of the R2 reactor, its associated facilities and its history is given. The facilities and range of work are described for the following types of activities: fuel testing, materials testing, neutron transmutation doping of silicon, activation analysis, radioisotope production and basic research including thermal neutron scattering, nuclear chemistry and neutron capture radiography. (author).

27723 (INIS-JP–020, pp. 47-58) **Ongoing refurbishment activities and strategy for the future operation of the BR2 reactor.** Koonen, E. (Centre d'Etude de l'Energie Nucleaire, Mol (Belgium)); Gubel, P. Japan Atomic Energy Research Inst., Tokyo (Japan). 1994. 359p. (CONF-9309370–: IGORR-III: 3. meeting of the international group on research reactors, Naka (Japan), 30 Sep - 1 oct 1993). In *Proceedings of the third meeting of the international group on research reactors (IGORR-III).* Order Number DE94765352. Source: OSTI; NTIS; INIS.

The operation of the BR2 reactor with its second Be-matrix is foreseen up to mid-1995 or mid-1996. A life extension for another 15 years is envisaged considering programmatic, financial and technical aspects. At present, the second phase of the refurbishment programme is being executed. The major activities of this programme can be grouped under two headings: safety reassessment and ageing issues. The expected outcome end '93 is an assessment report defining extent, choosen options, prioritized activities, budget and a tentative planning for the preparation and execution of the refurbishment. These aspects together with the prospects of possible cooperation with other parties for the refurbishment programme and the future operation of BR2 will be evaluated by the CEN/SCK Board who has to take a decision early in 1994. Various scenarios are now being considered and evaluated for the refurbishment and the future BR2 operation regime. (author).

27724 (INIS-JP–020, pp. 59-75) **The reactor and cold neutron research facility at NIST.** Prask, H.J. (National Inst. of Standards and Technology (IMSE), Gaithersburg, MD (United States). Reactor Radiation Div.); Rowe, J.M. Japan Atomic Energy Research Inst., Tokyo (Japan). 1994. 359p. (CONF-9309370–: IGORR-III: 3. meeting of the international group on research reactors, Naka (Japan), 30 Sep - 1 oct 1993). In *Proceedings of the third meeting of the international group on research reactors*

(IGORR-III). Order Number DE94765352. Source: OSTI; NTIS; INIS.

The NIST Reactor (NBSR) and Cold Neutron Research Facility (CNRF) are located at the Gaithersburg, MD site, and have been in operation since 1969 and 1991, respectively. A total of 26 thermal neutron facilities and 11 cold neutron stations are operating for studies in condensed matter physics and chemistry, materials science, chemical analysis, nondestructive evaluation, neutron standards, fundamental neutron physics, and irradiations. Thermal and cold neutron instruments which have become operational since the 2d IGORR Conference will be described. Major facility upgrades to be implemented in early 1994 will be outlined. (author).

27725 (INIS-JP–020, pp. 76-86) **Present status of JRR-3M.** Shirai, Eiji (Japan Atomic Energy Research Inst., Tokai, Ibaraki (Japan). Tokai Research Establishment). Japan Atomic Energy Research Inst., Tokyo (Japan). 1994. 359p. (CONF-9309370–: IGORR-III: 3. meeting of the international group on research reactors, Naka (Japan), 30 Sep - 1 oct 1993). In *Proceedings of the third meeting of the international group on research reactors (IGORR-III).* Order Number DE94765352. Source: OSTI; NTIS; INIS.

JRR-3 was a heavy water moderated and cooled tank type reactor with slightly enriched uranium fuels. JRR-3 was constructed by Japanese staff for studying the reactor technology in Japan. Its thermal output was 10 MW and it was operated and utilized for about twenty years. But its thermal neutron flux was an order of 10^{13} n/cm^2·sec and slightly low for the recent demand of research and developments, therefore JRR-3 was modified and upgraded to JRR-3M. Modification works were started in 1986 and got the first criticality in March, 1990. After that, JRR-3M has been operated successfully. (author).

27726 (INIS-JP–020, pp. 87-114) **Status of FRJ-2 Refurbishment of tank pipes and essential results of aging analysis.** Hansen, G. (Forschungszentrum Juelich GmbH (Germany). Zentralabteilung Forschungsreaktoren und Kerntechnische Betriebe); Thamm, G.; Thome, M. Japan Atomic Energy Research Inst., Tokyo (Japan). 1994. 359p. (CONF-9309370–: IGORR-III: 3. meeting of the international group on research reactors, Naka (Japan), 30 Sep - 1 oct 1993). In *Proceedings of the third meeting of the international group on research reactors (IGORR-III).* Order Number DE94765352. Source: OSTI; NTIS; INIS.

An aging evaluation program for FRJ-2 (DIDO) of the Forschungszentrum Juelich GmbH has been developed and is currently executed in cooperation with the licensing and regulatory and TUEV experts in order to determine the overall life expectancy of the facility and to identify critical systems and components that need to be upgraded or refurbished for future safe reactor operation. In Phase A (completed) a so called master list of the FRJ-2 mechanical, electrical and structural components was compiled on a system-by system basis and the operational documentation with respect to regular inspections, maintenance, repair and unusual occurrences was carefully examined. Critical components were selected and their ageing respectively life limiting mechanisms identified. In Phase B (currently under way) special inspections, examinations and tests for critical systems/components are being elaborated, executed and evaluated. Current work is being concentrated on non replaceable components (e.g. reactor aluminium tank (RAT) and the connecting pipes to the primary cooling circuit, the reactor steel tank and pipe work inside the concrete reactor block). As a consequence of first results of the aging evaluation program and due to leaks in the weir and drain pipes of the RAT a repair/refurbishment program was set up for the Al-RAT pipes (risers, downcomers, weir and drain pipes) and the steel guide tubes. Details of the r/r program which is in far progress and first essential results of the aging evaluation will be presented. The results achieved until today are encouraging with respect to safe reactor operation on short and medium term. (J.P.N.).

27727 (INIS-JP–020, pp. 115-135) **Upgrade of the experimental facilities of the orphee reactor.** Farnoux, B. (CEA Centre d'Etudes de Saclay, 91 - Gif-sur-Yvette (France)); Breant, P. Japan Atomic Energy Research Inst., Tokyo (Japan). 1994. 359p. (CONF-9309370–: IGORR-III: 3. meeting of the international group on research reactors, Naka (Japan), 30 Sep - 1 oct 1993). In *Proceedings of the third meeting of the international group on research reactors (IGORR-III).* Order Number DE94765352. Source: OSTI; NTIS; INIS.

At the time of the design, the ORPHEE reactor has been equipped with a set of up-to-date experimental facilities such as nine tangential and horizontal beam holes, one hot source, two hydrogen cold sources and six neutron guides. After more than ten years of operations, all the neutron beams are now used by about twenty five spectrometers. A modernization program is under progress with a two fold aim: upgrade of the existing facilities and creation of new beams. Some details of the six following points will be described: (1) replacement of the flat cold source cell by an hollow cylinder in order first to increase the cold neutron flux and secondly to facilitate the extraction of new cold neutron beams. (2) replacement of the old neutron guide elements coated with natural nickel by new elements with isotopic nickel or super mirror coating. (3) modification of the curvature of some existing neutron guides in order to increase the wavelength band transmission. (4) creation of new cold neutron beams by installation of benders on the existing neutron guides. (5) design of new cold neutron guides and a new guide hall. (6) design of a thermal neutron guide. The two last points will made extensive use of super mirrors allowed by new technical developments done at the Laboratoire LEON BRILLOUIN in connection with industry. (author).

27728 (INIS-JP–020, pp. 137-143) **Status of the FRM-II project.** Boening, K. (Technische Univ. Muenchen, Garching (Germany). Fakultaet Fuer Physik). Japan Atomic Energy Research Inst., Tokyo (Japan). 1994. 359p. (CONF-9309370–: IGORR-III: 3. meeting of the international group on research reactors, Naka (Japan), 30 Sep - 1 oct 1993). In *Proceedings of the third meeting of the international group on research reactors (IGORR-III).* Order Number DE94765352. Source: OSTI; NTIS; INIS.

The new research reactor FRM-II at Garching near Munich is planned to become a high performance source of slow neutrons in Germany. Its design concept provides for a very compact reactor core cooled by light water and placed within a heavy water moderator tank, where a high thermal neutron flux will be obtained at only 20 MW power. - This paper begins with an overview over some of the essential design features and some more recent design modifications. It then reports on the status of the project, the most important event being a positive decision which the Bavarian State Government has made in January 1993 and which represented a green light for the project to enter the next project phase. Consequently, two official requests have been made by the Technical University of Munich, one for the nuclear licensing of the facility and the other for the so called 'Raumordnungsverfahren'. In this context the final version of the FRM-II safety report has been submitted to the nuclear licensing authority. (author).

27729 (INIS-JP–020, pp. 144-154) **Progress towards a new Canadian irradiation-research facility.** Lee, A.G. (Atomic Energy of Canada Ltd., Pinawa, MB (Canada). Whiteshell Nuclear Research Establishment); Lidstone, R.F. Japan Atomic Energy Research Inst., Tokyo (Japan). 1994. 359p. (CONF-9309370–: IGORR-III: 3. meeting of the international group on research reactors, Naka (Japan), 30 Sep - 1 oct 1993). In *Proceedings of the third meeting of the international group on research reactors (IGORR-III).* Order Number DE94765352. Source: OSTI; NTIS; INIS.

AECL is at an early stage in its evaluation of options for future irradiation facilities. During the past year the irradiation requirements for the CANDU support research programs have been reviewed and a consensus on these requirements has been achieved. Work is currently in progress to interpret these irradiation requirements to provide detailed technical performance specifications for experimental facilities. Computer simulations of experimental facilities needed to satisfy various irradiation requirements are in progress. The initial calculations have identified how individual experimental facilities could perform in a MAPLE-MTR. Further analyses of fuel test loops and materials test rigs are under way to characterize interactions among the experimental facilities. As part of the options assessment, work has also been initiated to identify what irradiation capabilities can be provided in existing research reactors to cover near-term requirements. (J.P.N.).

27730 (INIS-JP–020, pp. 155-162) **A status report on the advanced neutron source project.** West, C.D. (Oak Ridge National Lab., TN (United States)). Japan Atomic Energy Research Inst., Tokyo (Japan). 1994. 359p. (CONF-9309370–: IGORR-III: 3. meeting of the international group on research reactors, Naka (Japan), 30 Sep - 1 oct 1993). In *Proceedings of the third meeting of the international group on research reactors (IGORR-III).* Order Number DE94765352. Source: OSTI; NTIS; INIS.

Design work on the Advanced Neutron Source facilities has progressed significantly, with cost saving changes to the buildings and other systems. The cold source design has advanced considerably, and in addition design work has been initiated on the hot neutron source and on a positron source. (J.P.N.).

27731 (INIS-JP–020, pp. 163-171) **The design characteristics and current status of KMRR.** Lee, J.T. (Korea Atomic Energy Research Inst., Taejeon (Korea, Republic of)); Lee, J.B.; Kim, B.K. Japan Atomic Energy Research Inst., Tokyo (Japan). 1994. 359p. (CONF-9309370–: IGORR-III: 3. meeting of the international group on research reactors, Naka (Japan), 30 Sep - 1 oct 1993). In *Proceedings of the third meeting of the international group on research reactors (IGORR-III).* Order Number DE94765352. Source: OSTI; NTIS; INIS.

The construction of the Korea Multi-purpose Research Reactor (KMRR) is scheduled to be completed by the end of 1994. The KMRR is equipped with several vertical holes for fuel test loop or capsule for the irradiation of reactor's structural materials, radioisotope production, neutron transmutation doping and neutron activation analysis. It also has several beam tubes for the neutron beam experiments. In this paper, the characteristics of neutron fluxes from physics analysis are summarized for the irradiation sites and experimental sites in the KMRR. And, the experimental facilities of the KMRR including hot cells for radioisotope production and irradiated material experiments are briefly described. Finally, mention is made of the construction status of the KMRR. (author).

27732 (INIS-JP–020, pp. 172-185) **The residual heat removal system of KMRR and flap valve design.** Lim, I.C. (Korea Atomic Energy Research Inst., Taejeon (Korea, Republic of)); Yang, Y.S.; Chae, H.T.; Park, C.; Han, C.H. Japan Atomic Energy Research Inst., Tokyo (Japan). 1994. 359p. (CONF-9309370–: IGORR-III: 3. meeting of the international group on research reactors, Naka (Japan), 30 Sep - 1 oct 1993). In *Proceedings of the third meeting of the international group on research reactors (IGORR-III).* Order Number DE94765352. Source: OSTI; NTIS; INIS.

A 30 MW_{th} research reactor, the so-called KMRR (Korea Multi-purpose Research Reactor), has been developed by the Korea Atomic Energy Research Institute. The KMRR is an upward-flowing, light-water-cooled and heavy-water-reflected research reactor with an open-tank-in-pool arrangement. At normal operation, the core heat is removed by forced convective flow maintained by two pumps in parallel and then discharged to the secondary cooling system (SCS) through two plate type heat exchangers. When the core power is less than 50% of the full power (FP) or one of the primary cooling system pumps should fail, KMRR can be operated with only one pump and one heat exchanger at a reduced power level. During reactor shutdown, the core decay heat is removed by the natural circulation through primary cooling system (PCS Natural Circulation) when the secondary flow is available. Otherwise, the core decay heat is dumped into the pool by gravity-driven circulating flow via the flap valves inside the pool (Pool Natural Circulation). This paper describes the residual heat removal capability by the natural circulation and the flap valve design in detail. (author).

27733 (INIS-JP–020, pp. 186-190) **Preliminary conceptual studies of REX 2000.** Merchie, F. (CEA Centre d'Etudes de Grenoble, 38 (France)); Baas, C.; Ballagny, A.; Chagrot, M.; Farny, G.; Barnier, M.; Pattou, A. Japan Atomic Energy Research Inst., Tokyo (Japan). 1994. 359p. (CONF-9309370–: IGORR-III: 3. meeting of the international group on research reactors, Naka (Japan), 30 Sep - 1 oct 1993). In *Proceedings of the third meeting of the international group on research reactors (IGORR-III).* Order Number DE94765352. Source: OSTI; NTIS; INIS.

Nuclear R and D programs are, to some extent, completely dependent on research reactors availability. In France and others european countries, the major materials testings reactors were built in the sixties and are consequently ageing and reaching the end of their life, some of them having already been shut down. A situation with not a single large research reactor available in first half of next century cannot be imagined, given all the benefits drawn from the use of research reactors. The CEA has therefore started to evaluate the needs for neutron sources in the next four or five decades so as to design the most suitable new facilities to take over from the existing ones. REX 2000 is a new dedicated reactor project intended to meet the needs for fuels and materials testings after the year 2000. The preliminary conceptual studies which have been carried out along the last 18 months are presented and commented. (author).

27734 (INIS-JP–020, pp. 191-204) **Present status of high-temperature engineering test reactor (HTTR) program.** Tanaka, Toshiyuki (Japan Atomic Energy Research Inst., Oarai, Ibaraki (Japan). Oarai Research Establishment); Baba, Osamu; Shiozawa, Shusaku; Okubo, Minoru; Tobioka, Toshiaki. Japan Atomic Energy Research Inst., Tokyo (Japan). 1994. 359p. (CONF-9309370–: IGORR-III: 3. meeting of the international group on research reactors, Naka (Japan), 30 Sep - 1 oct 1993). In *Proceedings of the third meeting of the international group on research reactors (IGORR-III).* Order Number DE94765352. Source: OSTI; NTIS; INIS.

The 30MWt HTTR is a high-temperature gas-cooled reactor (HTGR), with a maximum helium coolant temperature of 950degC at the reactor outlet. The construction of the HTTR started in March 1991, with first criticality to be followed in 1998 after commissioning testing. At present the HTTR reactor building (underground part) and its containment vessel have been almost completed and its main components, such as a reactor pressure vessel (RPV), an intermediate heat exchanger, hot gas pipings and graphite core structures, are now manufacturing at their factories at the target of their installation starting in 1994. The project is intended to establish and upgrade the technology basis necessary for HTGR developments. Japan Atomic Energy Research Institute (JAERI) also plans to conduct material and fuel irradiation tests as an innovative basic research after attaining rated power and coolant temperature. Innovative basic researches are now in great request. The paper describes major features of HTTR, present status of its construction and research and test using HTTR. (author).

27735 (INIS-JP–020, pp. 205-210) **TRIGA research reactors with higher power density.** Whittemore, W.L. (General Atomics, San Diego, CA (United States)). Japan Atomic Energy Research Inst., Tokyo (Japan). 1994. 359p. (CONF-9309370–: IGORR-III: 3. meeting of the international group on research reactors, Naka (Japan), 30 Sep - 1 oct 1993). In *Proceedings of the third meeting of the international group on research reactors (IGORR-III).* Order Number DE94765352. Source: OSTI; NTIS; INIS.

The recent trend in new or upgraded research reactors is to higher power densities (hence higher neutron flux levels) but not necessarily to higher power levels. The TRIGA LEU fuel with burnable poison is available in small diameter fuel rods capable of high power per rod (≃48 kW/rod) with acceptable peak fuel temperatures. The performance of a 10-MW research reactor with a compact core of hexagonal TRIGA fuel clusters has been calculated in detail. With its light water coolant, beryllium and D_2O reflector regions, this reactor can provide in-core experiments with thermal fluxes in excess of 3×10^{14} n/cm^2·s and fast fluxes (>0.1 MeV) of 2×10^{14} n/cm^2·s. The core centerline thermal neutron flux in the D_2O reflector is about 2×10^{14} n/cm^2·s and the average core power density is about 230 kW/liter. Using other TRIGA fuel developed for 25-MW test reactors but arranged in hexagonal arrays, power densities in excess of 300 kW/liter are readily available. A core with TRIGA fuel operating at 15-MW and generating such a power density is capable of producing thermal neutron fluxes in a D_2O reflector of 3×10^{14} n/cm^2·s. A beryllium-filled central region of the core can further enhance the core leakage and hence the neutron flux in the reflector. (author).

27736 (INIS-JP–020, pp. 211-218) **Instrumentation of fuel elements and fuel plates.** Durand, J.P. (Compagnie pour l'Etude et la Realisation de Combustibles Atomiques (CERCA), 26 - Romans-sur-Isere (France)); Fanjas, Y. Japan Atomic Energy Research

Inst., Tokyo (Japan). 1994. 359p. (CONF-9309370–: IGORR-III: 3. meeting of the international group on research reactors, Naka (Japan), 30 Sep - 1 oct 1993). In *Proceedings of the third meeting of the international group on research reactors (IGORR-III).* Order Number DE94765352. Source: OSTI; NTIS; INIS.

When controlling the behaviour of a reactor or developing a new fuel concept, it is of utmost interest to have the possibility to confirm the thermohydraulic calculations by actual measurements in the fuel elements or in the fuel plates. For years, CERCA has developed the technology and supplied its customers with fuel elements equipped with pressure or temperature measuring devices according to the requirements. Recent customer projects have lead to the development of a new method to introduce thermocouples directly into the fuel plate meat instead of the cladding. The purpose of this paper is to review the various instrumentation possibilities available at CERCA. (author).

27737 (INIS-JP–020, pp. 230-251) **Two design aspects connected with the safety of the PIK reactor presently under construction.** Gostev, V.V. (AN SSSR, Leningrad (Russian Federation). Inst. Yadernoj Fiziki); Zakharov, A.S.; Konoplev, K.A.; Levandovskii, N.V.; Ploshchanskii, L.M.; Smolsky, S.L. Japan Atomic Energy Research Inst., Tokyo (Japan). 1994. 359p. (CONF-9309370–: IGORR-III: 3. meeting of the international group on research reactors, Naka (Japan), 30 Sep - 1 oct 1993). In *Proceedings of the third meeting of the international group on research reactors (IGORR-III).* Order Number DE94765352. Source: OSTI; NTIS; INIS.

The PIK reactor [1] is designed for physical research with neutron beams and sample irradiation. In the central trap the thermal neutrons flux is 4 x 10^{15} n/cm^2 s. The reactor power is 100 MW, the thermal neutron flux in the reflector at the maximum of distribution is 1 x 10^{15} n/cm^2 s. The core with a high uranium concentration of 600 g/l is light water-cooled, heavy water being used in the reflector. The code revision, a change of the authors ideas about the safety, and a shift of public attitude toward nuclear installations resulted in a stopping down of construction and project revision. In the course of the examination, the experts expressed doubts concerning two systems, namely, the containment and scram. It is these points that will be discussed in the present communication. (J.P.N.).

27738 (INIS-JP–020, pp. 252-263) **Present status of PIK gadolinium control.** Petrov, Yu.V. (AN SSSR, Leningrad (Russian Federation). Inst. Yadernoj Fiziki); Garusov, E.A.; Shustov, V.A. Japan Atomic Energy Research Inst., Tokyo (Japan). 1994. 359p. (CONF-9309370–: IGORR-III: 3. meeting of the international group on research reactors, Naka (Japan), 30 Sep - 1 oct 1993). In *Proceedings of the third meeting of the international group on research reactors (IGORR-III).* Order Number DE94765352. Source: OSTI; NTIS; INIS.

A liquid control element (LCE) containing a water solution of gadolinium nitrate $Gd(NO_3)_3$ was originally planned for use at the PIK reactor for partial compensation of poisoning and fuel burnup [1-3]. However, a further analysis has shown that quick forcing-out, boiling up or flowing-out of the absorbing solution (though of low probability) can lead to the dangerous prompt overcriticality of the reactor. The results of the analysis are presented as well as the upper limit of the reactivity, quick insertion of which still is safe for the reactor (J.P.N.).

27739 (INIS-JP–020, pp. 264-272) **Core thermal hydraulic tests for ANS.** Kaminaga, M. (Japan Atomic Energy Research Inst., Tokai, Ibaraki (Japan). Tokai Research Establishment); Siman-Tov, M.; Felde, D.K.; Yoder, G.L.; West, C.D. Japan Atomic Energy Research Inst., Tokyo (Japan). 1994. 359p. (CONF-9309370–: IGORR-III: 3. meeting of the international group on research reactors, Naka (Japan), 30 Sep - 1 oct 1993). In *Proceedings of the third meeting of the international group on research reactors (IGORR-III).* Order Number DE94765352. Source: OSTI; NTIS; INIS.

The Advanced Neutron Source Reactor (ANSR) is currently being developed by the Oak Ridge National Laboratory (ORNL) to become the world's highest-flux, steady-state, thermal neutron source for measurements and experiments in fields such as materials science and engineering, biology, chemistry and nuclear science. The ANSR is both cooled and moderated by heavy water and uses highly enriched uranium silicide fuel. The core has average and peak heat fluxes of 5.9 and 12 MW/m^2, respectively. Highly subcooled, heavy-water coolant flows vertically upward at a velocity of 25 m/s through parallel aluminum fuel-plates. In this configuration, both flow excursion (FE) and critical heat flux (CHF) represent potential thermal limitations. The availability of existing experimental data for both FE and CHF at the conditions applicable to the ANSR is very limited. A Thermal Hydraulic Test Loop facility was designed and built to simulate a full-length coolant subchannel of the core, allowing experimental determination of both thermal limits under the expected ANSR thermal-hydraulic conditions. A series of FE tests with light water flowing vertically upward was completed over a nominal heat flux range of 6-14 MW/m^2 and a corresponding velocity range of 8-21 m/s. Both the exit pressure (1.7 MPa) and inlet temperature (45degC) were maintained constant during these tests, while the loop was operated in a 'stiff' (constant flow) mode. To the authors' knowledge, no other FE data have been reported in the literature that cover the range and combination of conditions reported in this paper. Experimental work is currently proceeding to higher heat fluxes and coolant velocities. Final correlation of the FE data is postponed until the remainder of the experiments are performed. (author).

27740 (INIS-JP–020, pp. 285-300) **OSIRIS: the first M.T.R. with a new instrumentation and control system based on digital logic of vote.** Joly, C. (CEA Centre d'Etudes de Saclay, 91 - Gif-sur-Yvette (France)); Thiercelin, C.; Corre, J.; Dubois, J.F.; Contenson, G. de. Japan Atomic Energy Research Inst., Tokyo (Japan). 1994. 359p. (CONF-9309370–: IGORR-III: 3. meeting of the international group on research reactors, Naka (Japan), 30 Sep - 1 oct 1993). In *Proceedings of the third meeting of the international group on research reactors (IGORR-III).* Order Number DE94765352. Source: OSTI; NTIS; INIS.

OSIRIS, one of the French C.E.A. research reactors located at SACLAY, near PARIS, is since 27 years mainly devoted to production and irradiation technologies. To satisfy these objectives, OSIRIS is equipped by different test sections allowing mainly; (1) the long time irradiation of different materials including fuel rods, reactor vessel materials, fusion reactor components..., (2) the power ramps of fuel rods, (3) the Silicon doping, (4) the radioelements production, (5) the neutronography of materials and test sections. In most of the loops, the nuclear reactor conditions are fully simulated to approach as far as possible the exact behaviour of the materials. Through the new irradiation facilities under development, let's cite the OPERA test section foreseen for the simultaneous irradiation of 32 fuel rods with a maximum length of 2 m. To guarantee the safety and the high performances of the reactor, a continuous maintenance and improvement programme took place during the whole life of the reactor. The paper gives an overview of the part of this programme devoted to the replacement of the instrumentation and control system of the reactor. After 5 years study and development, the on site work took place in the second part of 1992 allowing a reactor start up beginning of 1993. (J.P.N.).

27741 (INIS-JP–020, pp. 325-331) **Development of supermirror and neutron bender.** Soyama, Kazuhiko (Japan Atomic Energy Research Inst., Tokai, Ibaraki (Japan). Tokai Research Establishment); Suzuki, Masatoshi; Kawabata, Yuji. Japan Atomic Energy Research Inst., Tokyo (Japan). 1994. 359p. (CONF-9309370–: IGORR-III: 3. meeting of the international group on research reactors, Naka (Japan), 30 Sep - 1 oct 1993). In *Proceedings of the third meeting of the international group on research reactors (IGORR-III).* Order Number DE94765352. Source: OSTI; NTIS; INIS.

The morphology and multilayer structure of Ni/Ti supermirrors which were deposited by evapolation system, have been investigated using neutron spectroscopy, Heterodyne profiler, TEM, and ESCA profiler. High reflectivity supermirror (>0.90) has been made by restraining surface roughness of the substrate, and the possibility to make a titanium oxide for diffusion barrier has been offered. The design of its application such as a neutron bender and a supermirror guide system applied to irradiation facility for cancer treatment, will be descrived. (author).

27742 (LA-SUB–94-82) **Mean importance measures for groups of events in fault trees.** Haskin, F.E. (New Mexico Univ., Albuquerque, NM (United States). Dept. of Chemical and Nuclear Engineering); Huang, Min; Sasser, M.K.; Stack, D.W. Los Alamos National Lab., NM (United States); New Mexico Univ., Albuquerque, NM (United States). Dept. of Chemical and Nuclear Engineering. 12 Oct 1993. 84p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. Order Number DE94015416. Source: OSTI; NTIS; INIS; GPO Dep.

The method of moments is applied to precisely determine the mean values of three importance measures: risk reduction, partial derivative, and variance reduction. Variance reduction calculations, in particular, are significantly improved by eliminating the imprecision associated with Monte Carlo estimates. The three importance measures are extended to permit analyses of the relative importance of groups of basic and initiating events. The partial derivative importance measure is extended by assessing the contribution of a group of events to the gradient of the top event frequency. The group importance measures are quantified for the overall fuel damage equation and for 14 dominant accident sequences from an independent probabilistic safety assessment of the K Production Reactor. This application demonstrates both the utility and the versatility of the group importance measures.

27743 (ORNL/TM–12775) **Fuel density, uranium enrichment, and performance studies for the Advanced Neutron Source reactor.** Alston, E.E.; Gehin, J.C.; West, C.D. Oak Ridge National Lab., TN (United States). Jun 1994. 46p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE94014955. Source: OSTI; NTIS; INIS; GPO Dep.

Consistent with the words of the budget request for the Advanced Neutron Source (ANS), DOE commissioned a study of the impact on performance of using medium- or low-enriched uranium (MEU or LEU) in the fuel of the reactor that generates the neutrons. In the course of the study, performance calculations for 19 different combinations of reactor core volume, fuel density and enrichment, power level, and other relevant parameters were carried out. Since then, another 14 cases have been analyzed at Oak Ridge to explore some of the more interesting and important configurations and to gain further insights into the tradeoffs between performance and enrichment. Furthermore, with the aid of the data from these additional cases, we have been able to correlate the most important performance parameters (peak thermal neutron flux in the reflector and core life) with reactor power, fuel density, and fuel enrichment. This enables us to investigate intermediate cases, or alternative cases that might be proposed by people within or outside the project, without the time and expense of doing completely new neutronics calculations for each new example. The main drivers of construction and operating costs are the reactor power level and the number of fuel plates to be fabricated each year; these quantities can be calculated from the correlations. The results show that the baseline two-element core design cannot be adapted to any practical fuel of greatly reduced enrichment without great performance penalties, but that a modification of the design, in which one additional fuel element is incorporated to provide extra volume for lower enrichment fuels, has the capability of using existing, or more advanced, fuel types to lower the uranium enrichment.

27744 (PNL–9982) **Summary of near-term options for Russian plutonium production reactors.** Newman, D.F.; Gesh, C.J.; Love, E.F.; Harms, S.L. Pacific Northwest Lab., Richland, WA (United States). Jul 1994. 77p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE94016810. Source: OSTI; NTIS; INIS; GPO Dep.

The Russian Federation desires to phase out the production of weapons-grade plutonium. To this end, ten graphite-moderated, water-cooled reactors have been shut down during the last several years. However, complete cessation of plutonium production is impeded because the three operating Russian reactors supply district heat and electricity to the Tomsk and Krasnoyarsk regions in addition to producing weapon-grade plutonium. In August 1992 the Russian Federation Ministry of Atomic Energy (MINATOM) and the Russian Nuclear Regulatory Agency (GAN) requested U.S. assistance for achieving a cessation of weapons-grade plutonium production, placing the plutonium production reactors under safeguards, and conducting a program to evaluate and assist in the upgrade of plant safety. As a result of that and subsequent communications, Secretary O'Leary and Minister Mikhailov have signed a protocol that expressed their desire to shut down the three remaining plutonium production reactors as soon as possible by replacing them with alternate energy sources. In the meantime, both MINATOM and the Department of Energy (DOE) are concerned about the safety of the plants as well as the difficulty in ceasing the production of plutonium as long as the plants continue to operate. A military subsidy has been provided for operation of the production reactor complex. Revenues received for providing district heat and electricity are insufficient to cover costs for the current natural uranium metal fuel cycle. A more economical fuel cycle is needed for civilian operations.

27745 (RL-GEN–1300-4) **Hanford Atomic Products Department: Monthly report, April 1967.** General Electric Co., Richland, WA (United States). Hanford Atomic Products Operation. 10 May 1967. 74p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE94015687. Source: OSTI; NTIS; GPO Dep.

During April the N-Reactor operated with a time operated efficiency of 70.8%; and a production availability and steam availability to Washington Public Power Supply System of 68.5%. No fuel element failures occurred. A scheduled outage (April 18 to 25) was used to complete planned maintenance, accomplish the modifications required for the 4,800 Mw power level probe, and for charging the fourth increment of the coproduct demonstration load. Fuel element input production was 100% of forecast. Output production was 110% of forecast, significantly improving finished-fuel inventories and reducing in-process material levels. Calendar-year-to-date output is 102% of forecast. There are now 844 columns of coproduct fuel in the reactor. Two columns of high exposure, 1.96% enriched, coproduct fuel (discharged during March) were examined. These fuels had attained a tube average exposure of 4,094 Mwd/t and operated at uranium temperatures of 550 C to 475 C (temperature range predicted for Mark 5 fuel). Cladding buckling was minimal. The superior performance is attributed to the 800 ppm Al plus 400 ppm Fe uranium alloy. Flow testing of the prototypic Mark 4 fuel continued during the month. Flow split data are being used to redesign the support system to balance the flow in the coolant channels. The first inner fuels of the Mark 4 design were successfully brazed using a chevron end-cap closure method which was developed to limit the stresses in the cap region which occur during irradiation. The analytical results from the first Pu-238 target column show that the quantities of plutonium isotopes produced and the neptunium consumed are in close agreement with predicted values.

27746 (RL-NRD–150-7C) **Monthly record report, Research and Engineering Operation N-Reactor Department.** Leverett, M.C. General Electric Co., Richland, WA (United States). Hanford Atomic Products Operation. 31 Jul 1965. 18p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE94015098. Source: OSTI; NTIS; GPO Dep.

A status report is given for the N Reactor. Brief summaries are included for the following technical activities: Co-product physics studies; Target melting calculations; Critical mass parameters; Stack flooding calculations; Co-product metal handling; Co-producer demonstration test; Thermal hydraulics; Primary cooling system supply characteristics; Fringe tube orificing; Fuel tube power split; Simulated driver-target test; Fuel element failure evaluation; 1.96% Integral-target production test; Conversion ratio tests; Fuel examination facility; Process tube monitoring; Corrosion monitoring; I-131 concentrations in river influent following ruptures; and Production of Np-237 and Pu-238 in the N Reactor.

27747 (RL-NRD–266-EX5) **M-1 N-Reactor fuel development: Excerpts from N-Reactor Department Research and Development Budget for FY-1967 and Revision of Budget for FY-1966.** General Electric Co., Richland, WA (United States). Hanford Atomic Products Operation. 19 Apr 1965. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE94015108. Source: OSTI; NTIS; GPO Dep.

The use of metallic uranium fuel elements on a large scale in a pressurized water cooled graphite moderated power reactor environment in N-Reactor not only represents an extrapolation from previous Hanford fuel technology but it represents the only production-scale application of this concept in this country or abroad. Provision of a supporting technology is and will continue to be a major activity at Hanford as only a limited amount of directly applicable R&D will be available from other sites. The major benefit to be achieved through an extensive and continuing fuel program is attainment of the full capabilities of the N-Reactor at much reduced fuel cycle costs. The current N-Reactor fuel design represents the best engineering judgment of what is required for adequate performance. While the design is intentionally conservative, some features may not fully provide the level of performance required to sustain efficient reactor operation. Results of production-scale irradiation experience and special test irradiations will provide direction to a continuing program to correct any excesses or deficiencies in the initial fuel design. Reduction of unwarranted conservatism in the design will lower fuel fabrication costs, and correction of deficiencies will lower irradiation costs through increased time operated efficiency. Costs of this program are summarized for 1965, 66, and 67. The paper describes the scope of the program, its relationship to other programs, and technical progress in FY-1965 which included improved performance of the fuel elements even with the large number of rapid shutdowns of the reactor.

27748 (RL-NRD–512) **Nuclear safety specifications for N-Reactor fuels for 2.4 w/o enriched uranium oxide fuel.** Black, B.R. General Electric Co., Richland, WA (United States). Hanford Atomic Products Operation. 16 Aug 1965. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE94015103. Source: OSTI; NTIS; GPO Dep.

This specification covers the processing of a pilot lot of 2.4 w/o uranium oxide fuel in the N-Reactor Fuels facilities for the period from August 16, 1965, through March 1, 1966. A maximum of 180 fuel pieces will be processed. The fuel will be processed or stored in 306, 333, and 3,715 Buildings. Processing steps will include end closure welding, support and locking clip welding, final etching, autoclaving, final inspection, and assembly. Shipment to 100-N Area and from 325 Building are also covered.

27749 (RL-REA–188) **Production test IP-734, HAPO 309: High core temperature capsules in the KW Snout facility, Series 2.** Cox, J.H. General Electric Co., Richland, WA (United States). Hanford Atomic Products Operation. 20 Nov 1964. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE94014848. Source: OSTI; NTIS; GPO Dep.

The objective of the production test detailed in this report is to continue a program started under Production Test IP-690; the major change is an increase in sample enrichment. The higher enrichment is required to increase the portion of the fuel element core which is molten. This test will provide data to correlate maximum fuel temperature with post-irradiation microstructure, and data that are required to study the kinetics of fuel redistribution during the time interval between insertion of the capsule, into a constant, established neutron flux, and the time at which a steady state equilibrium structure is reached. This information will permit calculation of high temperature heat transfer coefficients and their variation during initial stages of irradiation. A quantitative understanding of fuel relocation and the time required to reach equilibrium are needed for optimum design of ultra-high temperature fuel elements.

27750 (RL-REA–2249-D) **Research and Engineering Operation, Irradiation Processing Department: Monthly record report, August 1965.** Ambrose, T.W. General Electric Co., Richland, WA (United States). Hanford Atomic Products Operation. 3 Sep 1965. 22p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE94015682. Source: OSTI; NTIS; GPO Dep.

Brief summaries are given for the status of activities in the following areas: Reactor fuels; Reactor engineering; Reactor physics; Radiological engineering; Process standards; Process change authorization; Fuel failure experience; Pile physics assistance; Process physics studies; Testing of fuel elements; and Testing and irradiation services.

27751 (SAND–91-0501) **Prompt-period measurement of the Annular Core Research Reactor prompt neutron generation time.** Coats, R.L.; Talley, D.G.; Trowbridge, F.R. Sandia National Labs., Albuquerque, NM (United States). Jul 1994. 32p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. Order Number DE94016768. Source: OSTI; NTIS; INIS; GPO Dep.

The prompt neutron generation time for the Annular Core Research Reactor was experimentally determined using a prompt-period technique. The resultant value of 25.5 μs agreed well with the analytically determined value of 24 μs. The three different methods of reactivity insertion determination yielded $\pm$5% agreement in the experimental values of the prompt neutron generation time. Discrepancies observed in reactivity insertion values determined by the three methods used (transient rod position, relative delayed critical control rod positions, and relative transient rod and control rod positions) were investigated to a limited extent. Rod-shadowing and low power fuel/coolant heat-up were addressed as possible causes of the discrepancies.

27752 (SAND–93-2697C) **Fast shutter for low background radiation environments at SPR III.** Kelly, J.G. (Sandia National Labs., Albuquerque, NM (United States)); Sites, K.; Scott, W. Sandia National Labs., Albuquerque, NM (United States). [1994]. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. (CONF-940726–13: 31. annual international nuclear and space radiation effects conference, Tucson, AZ (United States), 18-22 Jul 1994). Order Number DE94016553. Source: OSTI; NTIS; INIS; GPO Dep.

A fast shutter system has been developed and used to isolate experiments from the radiation emitted after the main pulse of the Sandia Pulse Reactor, SPR 3. In about 15 ms the system moves a massive 20 kg shield in front of the beam port aperture in the facility shield wall. A second gravity-driven shutter is dropped into place in about 200 ms. The total attenuation achieved in the beam intensity is about a factor of one hundred. The shutter assembly was used, along with a sensitive detection system, to observe the gamma ray flux emitted by various materials activated by the neutron beam at levels nine orders of magnitude smaller than the gamma flux level at the target during the reactor pulse.

27753 (SR/H–747) **Technical Department report on Production Test No. 313-62-M: Effect of bar position on seating in the canning of heavy metal slugs.** Grills, R.C. Du Pont de Nemours (E.I.) and Co., Aiken, SC (United States). 21 Mar 1945. 3p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-76SR00001. Order Number DE94014643. Source: OSTI; NTIS; GPO Dep.

Short communication. HANFORD PRODUCTION REACTORS/fuel rods; FUEL RODS/canning; CANNING; EXTRUSION; MACHINING; DEFORMATION; DEFECTS

27754 (SR/H–748) **Technical Department report on Production Test No. 313-60-M: Study of coolants used for machining heavy metal slugs.** Eubank, L.D. Du Pont de Nemours (E.I.) and Co., Wilmington, DE (United States). Engineering Dept. 27 Mar 1945. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-76SR00001. Order Number DE94014644. Source: OSTI; NTIS; GPO Dep.

Short communication. HANFORD PRODUCTION REACTORS/fuel rods; FUEL RODS/machining; COOLANTS/chemical composition; MACHINING; COOLANTS; PH VALUE; REACTIVITY; CHEMICAL ANALYSIS; FIRES

27755 (SR/H–749) **Technical Department report on Production Test No. 313-66-M: Variation in canning yields with "A" and "Z" slugs.** Eubank, L.D. Du Pont de Nemours (E.I.) and Co., Aiken, SC (United States). 11 Apr 1945. 3p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-76SR00001. Order Number DE94014645. Source: OSTI; NTIS; GPO Dep.

Short communication. HANFORD PRODUCTION REACTORS/ fuel rods; FUEL RODS/canning; FUEL RODS/fabrication; CANNING; FABRICATION; HEAT TREATMENTS; PRODUCTION; YIELDS; FAILURES; MACHINING; ANNEALING; RECOMMENDATIONS; TESTING

27756 (SR/H–750) **Report on Production Test No. 313-68-M: Recanning of warped slugs segregated after the centrifuge by technical warp gauge.** Du Pont de Nemours (E.I.) and Co., Aiken, SC (United States). Savannah River Lab. 20 Apr 1945. 3p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-76SR00001. Order Number DE94015372. Source: OSTI; NTIS; GPO Dep.

It has been found that warped slugs which produce "non-seats" segregated after the centrifuging operation by use of a suitable gauge. The slugs which do not pass the gauge are quenched in water and set aside for later recovery. The purpose of this test was to determine if the rejected slugs could be straightened, degreased and recanned by dipping them directly in the bronze and then through the subsequent steps. One hundred and twenty-nine slugs rejected by the warp gauge were straightened, degreased and recanned by dipping directly into the bronze bath, Eleven non-seats and one Al-Si spill over were rejected at the canning pot.The above procedure is recommended as a possible means of treating slugs rejected in the canning operation because of wrap.

27757 (SR/H–759) **Weekly progress report – Technical Section for period ending June 12, 1943.** Du Pont de Nemours (E.I.) and Co., Aiken, SC (United States). 15 Jun 1943. 14p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-76SR00001. Order Number DE94015705. Source: OSTI; NTIS; GPO Dep.

Progress was reported from the 300, 100, and 200 Areas. It covered the X pile, aluminium corrosion, graphite purity, fuel element fabrication, bismuth phosphate extraction and decontamination processes, waste disposal from bismuth phosphate processing, control rod systems for Site W, shielding problems at the Site W separation plant, fuel element failure detection, power distribution in the Clinton pile, reactor instrumentation for Site W.

27758 (SR/H–761) **Explosives TNX Technical Division, Hanford weekly report for period ending July 25, 1944.** Worthington, H. Du Pont de Nemours (E.I.) and Co., Wilmington, DE (United States). Explosives Dept. 26 Jul 1944. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-76SR00001. Order Number DE94016250. Source: OSTI; NTIS; GPO Dep.

Progress on finding suitable water conditions for start-up had been approached as closely as possible with our present equipment and information as to the requirements. The water composition should be attainable that is not corrosive or build up a film rapidly, and we have means available for removal of such films. Slug classification methods were analyzed from a dimensional standpoint. Analysis of current CMX data was undertaken with the objective of establishing allowable variations in pressure drop in W-tubes due to film formation. Calculations were made of the number of slugs which have jacket temperatures in excess of various values, for various loading arrangements. On July 26 the proposed loading of the discharge nozzle is to be checked on CMX tube 1 during an inspection shut-down. Evacuation procedures in the event of a catastrophe in the 100-B area were discussed with W.E. Rapp during a visit to that area on July 19, 1944. Tests for slug leaks will not be less severe with water in the autoclave than with steam, and have a considerable chance to be more decisive, especially if a wetting agent is added to the water. Calculations were made on the sensitivity to be expected from three types of ion chambers proposed for monitoring air activity near the tolerance level.

27759 (WHC-SA–2477) **Tensile properties of irradiated surveillance coupons.** Huang, F.H.; Blackburn, L.D. Westinghouse Hanford Co., Richland, WA (United States). Jun 1994. 13p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE94016471. Source: OSTI; NTIS; INIS; GPO Dep.

Tensile testing of austenitic steel and superalloy samples irradiated in the HMO 13 assembly was performed in support of the Fast Flux Test Facility (FFTF) Surveillance Program. Postirradiation yield stress, ultimate tensile stress, uniform elongation, total elongation, and reduction in area of 304 stainless steel (SS), 308 SS weld, 316 SS, A286, In718, and In718 weld were determined. Results showed the strength of austenitic steels increased while the ductility decreased as a result of irradiation. Low irradiation exposure produced little property change in In718. Overall, the tensile properties of HMO 13 surveillance coupons showed a lower magnitude of irradiation-induced property change than was expected based on earlier studies. Results from these tests gave no indications of unexpectedly severe irradiation damage to FFTF components.

27760 (WSRC-MS–94-0352) **ASME N510 test results for Savannah River Site AACS filter compartments.** Paul, J.D.; Punch, T.M. Westinghouse Savannah River Co., Aiken, SC (United States). [1994]. 13p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035. (CONF-940738–1: 23. DOE/NRC nuclear air cleaning and treatment conference, Buffalo, NY (United States), 25-28 Jul 1994). Order Number DE94014870. Source: OSTI; NTIS; GPO Dep.

The K-Reactor at the Savannah River Site recently implemented design improvements for the Airborne Activity Confinement System (AACS) by procuring, installing, and testing new Air Cleaning Units, or filter compartments, to ASME AG-1, N509, and N510 requirements. Specifically, these new units provide documentable seismic resistance to a Design, Basis Accident earthquake, provide 2 in. adsorber beds with 0.25 second residence time, and meet all AG-1, N509, and N510 requirements for testability and maintainability. This paper presents the results of the Site acceptance testing and discusses an issue associated with sample manifold qualification testing.

27761 (WSRC-TR–93-659) **Single annulus tests, final report: Columbia University Flow Instability Experimental Program, Volume 8.** Dougherty, T.; Maciuca, C.; McAssey, E.V. Jr.; Reddy, D.G.; Yang, B.W. Westinghouse Savannah River Co., Aiken, SC (United States). Dec 1992. 266p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035. Order Number DE94015497. Source: OSTI; NTIS; GPO Dep.

An experimental program has been conducted to determine the effect of fins on the onset of flow instability (OFI) in a vertical annulus under downflow conditions. This report presents the completion of an overall flow excursion program. Results are presented which show that the presence of fins which divide the annular flow section into four equal sub channels increases the OFI flowrate when compared to a finless annulus. In addition, the fins caused local flux peaking which resulted in premature CHF and the loss of the test section. The application of this CHF result to other conditions requires an adjustment for heater thermal conductivity.

27762 (WSRC-TR–93-682) **Columbia University Flow Instability Experimental Program, Volume 1: Single tube uniformly heated tests: Part 1, Technical discussion.** Dougherty, T.; Maciuca, C.; McAssey, E.V. Jr.; Reddy, D.G.; Yang, B.W. Westinghouse Savannah River Co., Aiken, SC (United States). Jan 1990. 154p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035. Order Number DE94015492. Source: OSTI; NTIS; GPO Dep.

An experimental program has been conducted to investigate flow instability in circular tubes under vertical down-flow conditions. The test section L/D ratio range was 86 to 270. The maximum test section surface heat flux was one million Btu/hr-ft^2. Over 1700 data points were obtained. The effect of flowrate, inlet temperature, exit pressure, and heat flux on the initiation of flow instability was determined. In addition, the data was used to evaluate various methods of predicting the onset of flow instability. Using the measured wall temperatures, surface temperatures and heat transfer coefficients have been obtained. Correlations for the heat transfer coefficient along the tube under both single and two phase conditions were developed.

27763 (WSRC-TR–93-685) **Single tube non-uniformly heated tube tests: Columbia University Flow Instability Experimental Program, Volume 4.** Dougherty, T.; Maciuca, C.; McAssey, E.V. Jr.; Reddy, D.G.; Yang, B.W. Westinghouse Savannah River Co., Aiken, SC (United States). Oct 1990. 165p. Sponsored by USDOE, Washington, DC (United States). DOE

Contract AC09-89SR18035. Order Number DE94015495. Source: OSTI; NTIS; GPO Dep.

A series of down flow experiments has been conducted on four different flux profile single tubes. The objective of these experiments was to determine the effect of non-uniform heating on the occurrence of flow instability. Each tube had the same inside diameter. The test profiles consisted of a uniformly heated tube, a cosine distribution tube, a double peak tube, and an exit peak tube. The onset of flow instability occurred at approximately the same flowrate for each tube; however, tubes with lower local fluxes in region experienced slightly lower flow rates at OFI.

27764 (WSRC-TR–93-690) **Single Tube Test Program Demand Curve Data Tables: Columbia University Flow Instability Experimental Program, Volume 9.** Coutts, D.A. Westinghouse Savannah River Co., Aiken, SC (United States). Sep 1993. 331p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035. Order Number DE94015460. Source: OSTI; NTIS; GPO Dep.

This report is one of a series of reports which document the flow instability testing conducted by Columbia University during 1989, through 1992. This testing was completed as part of AX1811457. Data files were transmitted to SRS in a DOS compatible format. This report volume provides a hardcopy version of the electronic media data files.

27765 (WSRC-TR–93-695) **Single Annulus Transient Test Program Data Tables, Part III: Columbia University Flow Instability Experimental Program, Volume 14.** Coutts, D.A. Westinghouse Savannah River Co., Aiken, SC (United States). Sep 1993. 459p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035. Order Number DE94014883. Source: OSTI; NTIS; GPO Dep.

This report is one of a series of reports which document the flow instability testing conducted by Columbia University during 1989, through 1992. This testing was completed as part of AX1811457. This report volume provides a hardcopy version of the electronic media data files.

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Refer also to citation(s) 27495, 27523, 27570, 27642, 27646, 27647, 27648, 27649, 27683, 27757, 28886

27766 (ANL/RE/CP–79356) **Transient dissolution of a steel structure in an aluminum melt pool.** Cheung, F.B. (Pennsylvania State Univ., University Park, PA (United States). Dept. of Mechanical Engineering); Yang, B.C.; Cho, D.H.; Tan, M.J. Argonne National Lab., IL (United States). Reactor Engineering Div. [1992]. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-921110–54: Winter annual meeting of the American Society of Mechanical Engineers (ASME), Anaheim, CA (United States), 8-13 Nov 1992). Order Number DE94014977. Source: OSTI; NTIS; INIS; GPO Dep.

A numerical model is developed to describe the process of transient dissolution of the interior surface of a reactor bottom head in a pool of molten aluminum resulting from a severe core meltdown accident. The model accounts for the transient heat conduction in the steel structure, the mass transfer due to dissolution, and the time variations of the bulk pool temperature and concentration. Results indicate that over the range of accident conditions considered in the study, the bulk pool always attains a saturated state while the interface temperature approaches an asymptotic value. Once this saturated state is achieved, no further dissolution would take place. For a given pool inventory, the critical time for achieving the saturated state is found to be a function of the Nusselt number and the dissolution coefficient. On the other hand, the fraction of the steel structure that is dissolved before reaching the saturated state is a function of the Nusselt number alone.

27767 (BNL-NUREG–49995) **PIUS scram reactivity analysis.** Carew, J.F.; Selcow, E.C.; Aronson, A. Brookhaven National Lab., Upton, NY (United States). [1994]. 14p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH00016. (CONF-940407–22: Topical meeting on advances in reactor physics, Knoxville, TN (United States), 11-14 Apr 1994). Order Number DE94015148. Source: OSTI; NTIS; INIS; GPO Dep.

A detailed evaluation of the scram reactivity for the PIUS reactor design has been carried out. The scram reactivity resulting from the injection of highly borated pool water was calculated for a series of time-dependent linear ramp and square-wave pool flows. The three-dimensional core distribution of the pool water was modeled and the spatial reactivity effects of the distributed boron were determined. For pool flows that increase as a linear ramp, the spatial reactivity effects of the distributed boron were very small. In this case, a constant core-average boron reactivity coefficient can be used to model the PIUS scram reactivity.

27768 (ECN-I–93-052) **Program for accident and incident management support, AIMS: Thermohydraulic models and visual interface.** Putra, M.A. Netherlands Energy Research Foundation (ECN), Petten (Netherlands). Dec 1993. 93p. Order Number DE94789637. Source: OSTI; NTIS; INIS.

A prototype of an advisory computer program is presented which could be used in monitoring and analyzing an ongoing incident in a nuclear power plant. The advisory computer program, called the Accident and Incident Management Support (AIMS), focuses on processing a set of data that is to be transmitted from a nuclear power plant to a national or regional emergency center during an incident. The AIMS program will assess the reactor conditions by processing the measured plant parameters. The applied model of the power plant contains a level of complexity that is comparable with the simplified plant model that the power plant operator uses. A standardized decay heat function and a steam water property library is used in the integral balance equations for mass and energy. A simulation of the station blackout accident of the Borssele plant is used to test the program. The program predicts successively: (1) the time of dryout of the steam generators, (2) the time of saturation of the primary system, and (3) the onset of core uncovery. The coolant system with the actual water levels will be displayed on the screen. (orig./HP)

27769 (HW–61849) **Report on preliminary laboratory experiments investigating consequences of failure of front hydraulic fittings in K reactor geometry.** Hesson, G.M.; Fitzsimmons, D.E. General Electric Co., Richland, WA (United States). Hanford Atomic Products Operation. 10 Sep 1959. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE94016395. Source: OSTI; NTIS; GPO Dep.

The purpose of this report is to present the results of a brief series of transient heat transfer experiments directed toward determining the possibility of damage to a K reactor should a front hydraulic connector fail to a tube containing I&E fuel elements. Nuclear heating of a train of 32 I&E slugs was simulated by electrically heating a rod in a K geometry process tube. Failure of a front fitting to such a tube was simulated by simultaneously and rapidly closing a valve in the water supply to the tue and opening a valve in a line which permitted discharge from the inlet of the tube through a front nozzle to atmosphere. Two to three seconds after the valve operation, a power reduction was initiated. The power reduction was in accord with an 800 inhour scram, except for two runs at 1,500 inhours. The reverse flow, rear header pressure and eight rod thermocouples, as well as other less important variables, were monitored. A test was continued until rod temperatures of 450 to 500 C were reached or until conditions of adequate cooling were established. With the exception of one run at 750 KW, all runs were with an initial tube power of 1,000 KW. The experimental program was terminated by failure of the test section.

27770 (INIS-JP–020, pp. 219-229) **Mechanism of ^{232}U production in MTR fuel evolution of activity in reprocessed uranium.** Harbonnier, G. (Compagnie pour l'Etude et la Realisation de Combustibles Atomiques (CERCA), 26 - Romans-sur-Isere (France)); Lelievre, B.; Fanjas, Y. Japan Atomic Energy Research Inst., Tokyo (Japan). 1994. 359p. (CONF-9309370–: IGORR-III: 3. meeting of the international group on research reactors, Naka (Japan), 30 Sep - 1 oct 1993). In *Proceedings of the third meeting of the international group on research reactors (IGORR-III)*. Order Number DE94765352. Source: OSTI; NTIS; INIS.

The use of reprocessed uranium for research reactor fuel fabrication implies to keep operators safe from the hard gamma rays

emitted by ^{232}U daughter products. CERCA has carried out, with the help of French CEA and COGEMA, a detailed study to determine the evolution of the radiation dose rate associated with the use of this material. (author).

27771 (INIS-JP–020, pp. 301-312) **Probabilistic safety analysis for FRJ-2 motivation, methodology and results.** Wolters, J. (Forschungszntrum Juelich GmbH (Germany). Inst. fuer Sicherheitsforschung und Reaktortechnik). Japan Atomic Energy Research Inst., Tokyo (Japan). 1994. 359p. (CONF-9309370–: IGORR-III: 3. meeting of the international group on research reactors, Naka (Japan), 30 Sep - 1 oct 1993). In *Proceedings of the third meeting of the international group on research reactors (IGORR-III).* Order Number DE94765352. Source: OSTI; NTIS; INIS.

A PSA of the Research Reactor FRJ-2 was performed to check the twenty-year-old safety system for weak points and to develop accident management as a 'fourth line of defence' against severe accidents according to a German initiative. The total core damage frequency proved to be $1.5 \cdot 10^{-4}$/a, which is consistent with figures found for other research reactors. Minor plant modifications will reduce the value by roughly a factor of 4, resulting in a frequency of $3 \cdot 10^{-7}$/a for a major release of fission products into the environment caused by an independent failure of the containment. The integrity of the gas-tight steel containment proved not to be endangered by any core damage accident. From the results and insights gained by the PSA, many accident management measures could be identified and defined for the emergency handbook. The most important measure is primary feed and bleed, for which the feed line already exists. (author).

27772 (LA-SUB–94-67) **A new emergency response model for MACCS: Final report.** Chanin, D.I. Los Alamos National Lab., NM (United States); Technadyne Engineering Consultants, Inc., Albuquerque, NM (United States). 11 Nov 1992. 32p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. Order Number DE94017051. Source: OSTI; NTIS (documentation only); ESTSC (complete software package), P.O. Box 1020, Oak Ridge, TN 37831-1020; INIS; GPO Dep.

Under DOE sponsorship, as directed by the Los Alamos National Laboratory (LANL), the MACCS code (version 1.5.11.1) [Ch92] was modified to implement a series of improvements in its modeling of emergency response actions. The purpose of this effort has been to aid the Westinghouse Savannah River Company (WSRC) in its performance of the Level III analysis for the Savannah River Site (SRS) probabilistic risk analysis (PRA) of K Reactor [Wo90]. To ensure its usefulness to WSRC, and facilitate the new model's eventual merger with other MACCS enhancements, close cooperation with WSRC and the MACCS development team at Sandia National Laboratories (SNL) was maintained throughout the project. These improvements are intended to allow a greater degree of flexibility in modeling the mitigative actions of evacuation and sheltering. The emergency response model in MACCS version 1.5.11.1 was developed to support NRC analyses of consequences from severe accidents at commercial nuclear power plants. The NRC code imposes unnecessary constraints on DOE safety analyses, particularly for consequences to onsite worker populations, and it has therefore been revamped. The changes to the code have been implemented in a manner that preserves previous modeling capabilities and therefore prior analyses can be repeated with the new code.

27773 (LA-SUB–94-85) **Calc-note for the K-reactor common cause event quantification: [Final subcontract].** Kindinger, J.P. (PLG, Inc., Washington, DC (United States)). Los Alamos National Lab., NM (United States); PLG, Inc., Washington, DC (United States). 2 Jul 1992. 86p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. Order Number DE94015418. Source: OSTI; NTIS; GPO Dep.

This report provides the Los Alamos National Laboratory's (LANL) proposed input to the calc-note for the K-reactor common cause event analysis. This input describes the development of common cause parameters from expert opinion.

27774 (NUREG/CR–6116-Vol.7) **Systems analysis programs for hands-on integrated reliability evaluations (SAPHIRE) Version 5.0: Fault tree, event tree, and piping & instrumentation diagram (FEP) editors reference manual: Volume 7.** McKay, M.K. (EG and G Idaho, Inc., Idaho Falls, ID (United States)); Skinner, N.L.; Wood, S.T. Nuclear Regulatory Commission, Washington, DC (United States). Div. of Safety Issue Resolution; EG and G Idaho, Inc., Idaho Falls, ID (United States). Jul 1994. 144p. Sponsored by Nuclear Regulatory Commission, Washington, DC (United States). DOE Contract AC07-76ID01570. (EGG–2716-Vol.7). Source: OSTI; NTIS; INIS; GPO.

The Systems Analysis Programs for Hands-on Integrated Reliability Evaluations (SAPHIRE) refers to a set of several microcomputer programs that were developed to create and analyze probabilistic risk assessments (PRAs), primarily for nuclear power plants. The Fault Tree, Event Tree, and Piping and Instrumentation Diagram (FEP) editors allow the user to graphically build and edit fault trees, and event trees, and piping and instrumentation diagrams (P and IDs). The software is designed to enable the independent use of the graphical-based editors found in the Integrated Reliability and Risk Assessment System (IRRAS). FEP is comprised of three separate editors (Fault Tree, Event Tree, and Piping and Instrumentation Diagram) and a utility module. This reference manual provides a screen-by-screen guide of the entire FEP System.

27775 (NUREG/CR–6128) **Piping benchmark problems for the ABB/CE System 80+ Standardized Plant.** Bezler, P. (Brookhaven National Lab., Upton, NY (United States)); DeGrassi, G.; Braverman, J.; Wang, Y.K. Nuclear Regulatory Commission, Washington, DC (United States). Div. of Engineering; Brookhaven National Lab., Upton, NY (United States). Jul 1994. 229p. Sponsored by Nuclear Regulatory Commission, Washington, DC (United States). DOE Contract AC02-76CH00016. (BNL-NUREG–52396). Source: OSTI; NTIS; INIS; GPO.

To satisfy the need for verification of the computer programs and modeling techniques that will be used to perform the final piping analyses for the ABB/Combustion Engineering System 80+ Standardized Plant, three benchmark problems were developed. The problems are representative piping systems subjected to representative dynamic loads with solutions developed using the methods being proposed for analysis for the System 80+ standard design. It will be required that the combined license licensees demonstrate that their solution to these problems are in agreement with the benchmark problem set. The first System 80+ piping benchmark is a uniform support motion response spectrum solution for one section of the feedwater piping subjected to safe shutdown seismic loads. The second System 80+ piping benchmark is a time history solution for the feedwater piping subjected to the transient loading induced by a water hammer. The third System 80+ piping benchmark is a time history solution of the pressurizer surge line subjected to the accelerations induced by a main steam line pipe break. The System 80+ reactor is an advanced PWR type.

27776 (NUREG/CR–6143-Vol.2-Pt.1A) **Evaluation of potential severe accidents during low power and shutdown operations at Grand Gulf, Unit 1: Analysis of core damage frequency from internal events for plant operational state 5 during a refueling outage (Main report, Sections 1–9): Volume 2, Part 1A.** Whitehead, D. (Sandia National Labs., Albuquerque, NM (United States)); Darby, J.; Yakle, J. Nuclear Regulatory Commission, Washington, DC (United States). Div. of Safety Issue Resolution; Sandia National Labs., Albuquerque, NM (United States). Jun 1994. 279p. Sponsored by Nuclear Regulatory Commission, Washington, DC (United States). DOE Contract AC04-94AL85000. (SAND–93-2440-Vol.2-Pt.1A). Source: OSTI; NTIS; INIS; GPO.

The program objectives include assessing the risks of severe accidents initiated during plant operational states (POS) other than full power operation and comparing the estimated core damage frequencies, important accident sequences, and other qualitative and quantitative results with those accidents initiated during full power operation. The objective of the Phase 1 study was to identify potential vulnerable plant configurations, to characterize the potential

core damage accident scenario frequencies, and to provide a foundation for a detailed Phase 2 analysis. In Phase 2 POS 5 (approximately Cold Shutdown) during a refueling outage was selected as the plant configuration to be analyzed. System models applicable for POS 5 conditions on the way down to refueling and on the way back up from refueling were developed and supporting thermal hydraulic analyses were performed to determine both the timing of the accidents and success criteria for systems. Initiating events that may occur during POS 5 were identified and accident sequence event trees were developed and quantified. Surviving sequences were examined for recovery potential, appropriate human recovery actions were incorporated into the sequence cut sets, and the sequences were then requantified. Those sequences surviving this preliminary recovery analysis were then reexamined during a time window analysis. The mean core damage frequency of the Grand Gulf plant due to internal events for POS 5 during a refueling outage is 2.0E-06 per year, and the 5th and 95th percentiles are 4.1E-07 and 5.4E-06 per year, respectively. This compares to the total core damage frequency of 4.0E-06 per year estimated in the NUREG-1150 study of full power operations.

27777 (NUREG/CR–6152) **Experiments to investigate direct containment heating phenomena with scaled models of the Surry Nuclear Power Plant.** Blanchat, T.K. (Sandia National Labs., Albuquerque, NM (United States)); Allen, M.D.; Pilch, M.M.; Nichols, R.T. Nuclear Regulatory Commission, Washington, DC (United States). Div. of Systems Research; Sandia National Labs., Albuquerque, NM (United States). Jun 1994. 202p. Sponsored by Nuclear Regulatory Commission, Washington, DC (United States). DOE Contract AC04-94AL85000. Source: OSTI; NTIS; INIS; GPO.

The Containment Technology Test Facility (CTTF) and the Surtsey Test Facility at Sandia National Laboratories are used to perform scaled experiments that simulate High Pressure Melt Ejection accidents in a nuclear power plant (NPP). These experiments are designed to investigate the effects of direct containment heating (DCH) phenomena on the containment load. High-temperature, chemically reactive melt (thermite) is ejected by high-pressure steam into a scale model of a reactor cavity. Debris is entrained by the steam blowdown into a containment model where specific phenomena, such as the effect of subcompartment structures, prototypic air/steam/hydrogen atmospheres, and hydrogen generation and combustion, can be studied. Four Integral Effects Tests (IETs) have been performed with scale models of the Surry NPP to investigate DCH phenomena. The $1/61^{th}$ scale Integral Effects Tests (IET-9, IET-10, and IET-11) were conducted in CTRF, which is a $1/6^{th}$ scale model of the Surry reactor containment building (RCB). The $1/10^{th}$ scale IET test (IET-12) was performed in the Surtsey vessel, which had been configured as a $1/10^{th}$ scale Surry RCB. Scale models were constructed in each of the facilities of the Surry structures, including the reactor pressure vessel, reactor support skirt, control rod drive missile shield, biological shield wall, cavity, instrument tunnel, residual heat removal platform and heat exchangers, seal table room and seal table, operating deck, and crane wall. This report describes these experiments and gives the results.

27778 (PNL-SA–22426) **Human reliability analysis for seismic events.** Vo, T.V. Pacific Northwest Lab., Richland, WA (United States). Mar 1994. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. (CONF-940312–59: 2. Probabilistic safety assessment and management conference (PSAM), San Diego, CA (United States), 20-24 Mar 1994). Order Number DE94011681. Source: OSTI; NTIS; INIS; GPO Dep.

This paper presents the human reliability analysis (HRA) for selected post-accident human actions for potential seismic events at the Savannah River Site K-Reactor. This HRA was performed in support of Revision 1 to the probabilistic risk assessment (PRA) for the K-Reactor and provides human error probabilities for use in this PRA. This work was funded by the US Department of Energy and was jointly managed and performed by the Westinghouse Savannah River Company and Pacific Northwest Laboratory.

27779 (SAND–93-1611C) **MELCOR development for existing and advanced reactors.** Summers, R.M. Sandia National Labs., Albuquerque, NM (United States). [1993]. 23p. Sponsored by Nuclear Regulatory Commission, Washington, DC (United States). DOE Contract AC04-94AL85000. (CONF-941074–1: 21. water reactor safety information meeting, Washington, DC (United States), 25-27 Oct 1994). Order Number DE94007936. Source: OSTI; NTIS; INIS; GPO Dep.

Recent efforts in MELCOR development to address previously identified deficiencies have resulted in release of MELCOR 1.8.2, a much-improved version of the code. Major new models have been implemented for direct containment heating, ice condensers, debris quenching, lower plenum debris behavior, core materials interactions' and radial relocation of debris. Significant improvements have also been made in the modeling of interfacial momentum exchange and in the modeling of fission product release, condensation/evaporation, and aerosol behavior. Efforts are underway to address two-phase hydrodynamics difficulties, to improve modeling of water condensation on structures and fine-scale natural circulation within the reactor vessel, and to implement CORCON-Mod3. Improvements are also being made to MELCOR's capability to handle new features of the advanced light water reactor designs, including drainage of water films on connected heat structures, heat transfer from the external surface of the reactor vessel to a flooded cavity, and creep rupture failure of the lower head. Additional development needs in other areas are discussed.

27780 (WSRC-TR–93-614) **Criticality safety evaluation for disassembly basin sand filter.** Rosser, M.A. Westinghouse Savannah River Co., Aiken, SC (United States). 19 May 1994. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035. Order Number DE94015835. Source: OSTI; NTIS; INIS; GPO Dep.

As a result of the Reactor Division's disassembly basin cleanup program, it has been determined that fissile-isotopes are present in the sludge that has accumulated at the bottom of the disassembly basins. Good criticality safety practices require that the potential for obtaining a critical configuration with this fissile material be evaluated. As part of this process, the disassembly basin sand filter system has been identified as a potential area of concern. Because disassembly basin water flows through the sand filter, it is conceivable that fissile material, from the basin, could accumulate in the sand filter. Previous calculations have indicated that the mass of some fissile isotopes in the basin sludge exceeds subcritical mass limits. This report documents the criticality safety evaluation that was performed to address the possibility of forming a critical configuration within the sand filter. This evaluation is applicable to K and L Areas, since the fissile masses listed in Table 1 are bounding for both areas. Applicability to P Area will be examined following the completion of sludge sample analyses for that Area. Although it is conceivable that fissile material could accumulate in the sand filter, because of the required fissile mass and necessary critical geometries it is highly unlikely that a critical configuration could be assembled. The mass of fissile material required for criticality, for present and anticipated sand filter geometries and operational characteristics, is much greater than that available in the sludge, as indicated by sludge sample analyses. In short, there is no identified mechanism by which a critical configuration could be assembled in the disassembly basin sand filter.

27781 (WSRC-TR–93-683) **Columbia University flow instability experimental program: Volume 2: Single tube uniformly heated tests – Part 2: Uncertainty analysis and data.** Dougherty, T.; Maciuca, C.; McAssey, E.V. Jr.; Reddy, D.G.; Yang, B.W. Westinghouse Savannah River Co., Aiken, SC (United States). May 1990. 170p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035. Order Number DE94015493. Source: OSTI; NTIS; INIS; GPO Dep.

In June 1988, Savannah River Laboratory requested that the Heat Transfer Research Facility modify the flow excursion program, which had been in progress since November 1987, to include testing of single tubes in vertical down-flow over a range of length to diameter (L/D) ratios of 100 to 500. The impetus for the request was the desire to obtain experimental data as quickly as possible for code development work. In July 1988, HTRF submitted a proposal to SRL indicating that by modifying a facility already under construction the data could be obtained within three to four months. In January 1990, HTFR issued report CU-HTRF-T4, part 1. This report contained the technical discussion of the results from

the single tube uniformly heated tests. The present report is part 2 of CU-HTRF-T4 which contains further discussion of the uncertainty analysis and the complete set of data.

27782 (WSRC-TR–93-684) **Columbia University flow instability experimental program: Volume 3: Single tube parallel flow tests.** Dougherty, T.; Maciuca, C.; McAssey, E.V. Jr.; Reddy, D.G.; Yang, B.W. Westinghouse Savannah River Co., Aiken, SC (United States). Jun 1990. 106p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035. Order Number DE94015496. Source: OSTI; NTIS; GPO Dep.

The coolant in the Savannah River Site (SRS) production nuclear reactor assemblies is circulated as a subcooled liquid under normal operating conditions. This coolant is evenly distributed throughout multiple annular flow channels with a uniform pressure profile across each coolant flow channel. During the postulated Loss of Coolant Accident (LOCA), which is initiated by a hypothetical guillotine pipe break, the coolant flow through the reactor assemblies is significantly reduced. The flow reduction and accompanying power reduction (after shutdown is initiated) occur in the first 1–2 seconds of the LOCA. This portion of the LOCA is referred to as the Flow Instability phase. A series of down flow experiments have been conducted on three different size single tubes. The objective of these experiments was to determine the effect of a parallel flow path on the occurrence of flow instability. In all cases, it has been shown that the point of flow instability (OFI) determined under controlled flow operation does not change when operating in a controlled pressure drop mode (parallel path operation).

27783 (WSRC-TR–93-686) **Columbia University Flow Instability Experimental Program, Volume 5: Single annulus tests, steady-state test program.** Dougherty, T.; Maciuca, C.; McAssey, E.V. Jr.; Reddy, D.G.; Yang, B.W. Westinghouse Savannah River Co., Aiken, SC (United States). Jul 1991. 96p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035. Order Number DE94015494. Source: OSTI; NTIS; INIS; GPO Dep.

This report presents results for the steady state portion of the finless single annulus test program. The objective of the experimental study was to investigate the onset of flow instability in an annular geometry similar to the MARK 22 reactor. The test program involved testing of both a finless or ribless heater and a ribbed heater. The latter program is currently underway and will be reported separately. For finless heater, testing was conducted in both a steady state and transient mode. The present report presents steady state results for a series of experiments with uniform and asymmetric heating. The demand curves obtained under uniform heating yielded OFI flow-rates which were slightly below those obtained for a circular tube geometry with the same L/D ratio; however, the single annulus had a hydraulic diameter which was approximately fifty percent larger than the circular tube. The asymmetric heating cases were selected to provide the same average power input as the uniform cases. The results for these tests indicated that the flow-rate at OFI increased with the degree of asymmetry.

27784 (WSRC-TR–93-687) **Columbia University flow instability experimental program: Volume 6: Single annulus tests, transient test program.** Dougherty, T.; Maciuca, C.; McAssey, E.V. Jr.; Reddy, D.G.; Yang, B.W. Westinghouse Savannah River Co., Aiken, SC (United States). Sep 1992. 212p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035. Order Number DE94015499. Source: OSTI; NTIS; INIS; GPO Dep.

The coolant in the Savannah River Site (SRS) production nuclear reactor assemblies is circulated as a subcooled liquid under normal operating conditions. This coolant is evenly distributed throughout multiple annular flow channels with a uniform pressure profile across each coolant flow channel. During the postulated Loss of Coolant Accident (LOCA), which is initiated by a hypothetical guillotine pipe break, the coolant flow through the reactor assemblies is significantly reduced. The flow reduction and accompanying power reduction (after shutdown is initiated) occur in the first 1 to 2 seconds of the LOCA. This portion of the LOCA is referred to as the Flow Instability phase. This report presents the experimental results for the transient portion of the single annulus test program. The test program was designed to investigate the onset of flow instability in an annular geometry similar to the MARK 22 reactor. The test program involved testing of both a ribless heater and a ribbed heater under steady state as well as transient conditions. The ribbed heater testing is currently underway and will be reported separately. The steady state portion of this test program with ribless heater was completed and reported in report No. CU-HTRF-T3A. The present report presents transient test results obtained from a ribless, uniform annulus test section. A total of thirty five transients were conducted with six cases in which flow excursion occurred. No unstable conditions resulted for tests in which the steady state Q_{ratio} OFI limit was not exceeded.

27785 (WSRC-TR–93-688) **Columbia University flow instability experimental program: Volume 7: Single tube tests, critical heat flux test program.** Dougherty, T.; Maciuca, C.; McAssey, E.V. Jr.; Reddy, D.G.; Yang, B.W. Westinghouse Savannah River Co., Aiken, SC (United States). Sep 1992. 104p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035. Order Number DE94015498. Source: OSTI; NTIS; INIS; GPO Dep.

This report deals with critical heat flux (CHF) measurements in vertical down flow of water at low pressures in a round Inconel tube, 96 inches long and 0.62 inch inside diameter. A total of 28 CHF points were obtained. These data were found to correlate linearly with the single variable q, defined as the heat flux required to raise the enthalpy from the inlet value to the saturation value. These results were compared to the published results of Swedish investigators for vertical upflow of water at low pressures in round tubes of similar diameters and various lengths. The parameter q depends on the inlet enthalpy and is a nonlocal variable, thus this correlation is nonlocal unless the coefficients depend upon tube length in a particular prescribed manner. For the low pressure Swedish data, the coefficients are practically independent of length and hence the correlation is nonlocal. In the present investigation only one length was employed, so it is not possible to determine whether the correlation for these data is local or nonlocal, although there is reason to believe that it is local. The same correlation was applied to a large data base (thousands of CHF points) compiled from the published data of a number of groups and found to apply, with reasonable accuracy over a wide range of conditions, yielding sometimes local and sometimes nonlocal correlations. The basic philosophy of data analysis here was not to generate a single correlation which would reproduce all data, but to search for correlations which apply adequately over some range and which might have some mechanistic significance. The tentative conclusion is that at least two mechanisms appear operative, leading to two types of correlations, one local, the other nonlocal.

27786 (WSRC-TR–93-691) **Columbia University Flow Instability Experimental Program, Volume 10: Critical Heat Flux Test Program data tables.** Coutts, D.A. Westinghouse Savannah River Co., Aiken, SC (United States). Sep 1993. 346p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035. Order Number DE94015461. Source: OSTI; NTIS; GPO Dep.

This report is one of a series of reports which document the flow instability testing conducted by Columbia University during 1989 through 1992. This report volume provides a hardcopy version of the twenty-six electronic media data files: CO515(A-D).DAT, CO525(A-G). DAT, CO530(A-K).DAT, CO718(A-E).DAT.

27787 (WSRC-TR–93-692) **Columbia University flow instability experimental program: Volume 11: Single annulus steady-state test program data tables.** Coutts, D.A. Westinghouse Savannah River Co., Aiken, SC (United States). Sep 1993. 218p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035. Order Number DE94015491. Source: OSTI; NTIS; GPO Dep.

The single annulus test program was designed to investigate the onset of flow instability in an annular geometry similar to the fuel assemblies used in the Savannah River Site production reactors. Data files were transmitted from Columbia University to Savannah River Site in a DOS compatible format. This report provides a hardcopy version of the electronic media data files.

27788 (WSRC-TR–93-693) **Columbia University flow instability experimental program: Volume 12: Single annulus transient test program data tables: Part 1.** Coutts, D.A. Westinghouse Savannah River Co., Aiken, SC (United States). Sep 1993. 389p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035. Order Number DE94015489. Source: OSTI; NTIS; GPO Dep.

The single annulus test program was designed to investigate the onset of flow instability in an annular geometry similar to the fuel assemblies used in the Savannah River Site production reactors. Data files were transmitted from Columbia University to Savannah River Site in a DOS compatible format. This report provides a hardcopy version of the electronic media data files.

27789 (WSRC-TR–93-694) **Columbia University Flow Instability Experimental Program, Volume 13: Single annulus transient test program data tables, Part 2.** Coutts, D.A. Westinghouse Savannah River Co., Aiken, SC (United States). Sep 1993. 451p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035. Order Number DE94015490. Source: OSTI; NTIS; GPO Dep.

This report is one of a series of reports which document the flow instability testing conducted by Columbia University during 1989 through 1992. This testing was completed as part of AX1811457. This report volume provides a hardcopy version of the thirty-four electronic media files: SA0914(A-H).DAT, SAT0609(A-N).DAT, SAT0612(A-O).DAT.

24 POWER TRANSMISSION AND DISTRIBUTION

2401 Power Systems

27790 (LA-SUB–94-83) **Identification, definition and evaluation of potential impacts facing the US electric utility industry over the next decade: Final report.** Grainger, J.J.; Lee, S.S.H. Grainger (John) and Associates, Danville, CA (United States). 26 Nov 1993. 80p. Sponsored by Department of Defense, Washington, DC (United States). DOE Contract W-7405-ENG-36. Order Number DE94015417. Source: OSTI; NTIS; GPO Dep.

There are numerous conditions of the generation system that may ultimately develop into system states affecting system reliability and security. Such generation system conditions should also be considered when evaluating the potential impacts on system operations. The following five issues have been identified to impact system reliability and security to the greatest extent: transmission access/retail wheeling; non-utility generators and independent power producers; integration of dispersed storage and generation into utility distribution systems; EMF and right-of-way limitations; Clean Air Act Amendments. Strictly speaking, some issues are interrelated and one issue cannot be completely dissociated from the others. However, this report addresses individual issues separately in order to determine all major aspects of bulk power system operations affected by each issue. The impacts of the five issues on power system reliability and security are summarized. This report examines the five critical issues that the US electric utility industry will be facing over the next decade. The investigation of their impacts on utility industry will be facing over the next decade. The investigation of their impacts on utility system reliability and security is limited to the system operation viewpoint. Those five issues will undoubtedly influence various planning aspects of the bulk transmission system. However, those subjects are beyond the scope of this report. While the issues will also influence the restructure and business of the utility industry politically, sociologically, environmentally, and economically, all discussion included in the report are focused only on technical ramifications.

2402 Power System Networks, Transmission and Distribution

27791 (SAND–94-1715C) **Modeling of transformers using circuit simulators.** Archer, W.E.; Deveney, M.F.; Nagel, R.L. Sandia National Labs., Albuquerque, NM (United States). [1994]. 18p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. (CONF-9409166–1: Electrical manufacturing and coil winding conference, Chicago, IL (United States), 27 Sep 1994). Order Number DE94014656. Source: OSTI; NTIS; GPO Dep.

Transformers of two different designs; and unencapsulated pot core and an encapsulated toroidal core have been modeled for circuit analysis with circuit simulation tools. We selected MicroSim's PSPICE and Anology's SABER as the simulation tools and used experimental BH Loop and network analyzer measurements to generate the needed input data. The models are compared for accuracy and convergence using the circuit simulators. Results are presented which demonstrate the effects on circuit performance from magnetic core losses, eddy currents, and mechanical stress on the magnetic cores.

2407 Economic, Industrial, and Business Aspects

27792 (DOE/BP–2267) **Bonneville Power Administration 1993 annual report.** Hardy, R.W. USDOE Bonneville Power Administration, Portland, OR (United States). Jan 1994. 58p. Sponsored by USDOE, Washington, DC (United States). Order Number DE94015997. Source: OSTI; NTIS; GPO Dep.

For the first time in a decade, Bonneville had to propose a double digit rate increase in 1993. Many of the causes were beyond our control, but self-examination and painful budget cuts put the focus squarely where it should be – on the changes needed for BPA to compete in an increasingly market-driven business environment. As deregulation and change sweep the electricity industry, BPA has launched a major Competitiveness Project. It's clear that we can, and will, cut costs and make ourselves more efficient. We can shape our products and services to better reflect what customers want and are willing to pay for. And more than ever we will measure and reward output – results – more than process. BPA today is the Northwest's low-cost supplier of electricity and transmission services. To stay that way, we must adopt a more business-like model. The move does not signal a rejection of our role as a federal agency. In fact, close attention to sound business principles is the only way to strengthen our commitment to fish and wildlife, environment, and other community values.

25 ENERGY STORAGE

2506 Thermal

27793 (PNL-SA–22844) **Thermal energy storage in utility-scale applications.** Somasundaram, S.; Drost, M.K.; Brown, D.R.; Antoniak, Z.I. Pacific Northwest Lab., Richland, WA (United States). Aug 1994. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. (CONF-9408114–1: CALORSTOCK '94 conference, Espoo (Finland), 22-25 Aug 1994). Order Number DE94014560. Source: OSTI; NTIS; GPO Dep.

The Thermal Energy Storage (TES) Progran focuses on developing TES for daily cycling (diurnal storage), annual cycling (seasonal storage), and utility-scale applications [utility thermal energy storage (UTES)]. TES technology can be used in a new or an existing power generation facility to increase its efficiency and promote the use of this technology within the utility and the industrial sectors. The UTES project has included studies of both heat and cool storage systems for different, utility-scale applications. For example, one study showed that a molten salt TES system can substantially reduce the cost of coal-fired peak and intermediate load power production in an integrated gasification combined-cycle (IGCC) plant. The levelized energy cost (LEC) of an IGCC/TES plant can be reduced by as much as 20% over the LEC of a conventional IGCC plant. This concept produces lower-cost power than the natural-gas-fired alternative if significant escalation rates in the fuel

price are assumed. In another study, an oil/rock diurnal TES system when integrated with a simple gas turbine cogeneration system was shown to produce on-peak power,for $0.045 to $0.06/kWh while supplying a 24-hour process steam load. The molten salt storage system was found to be less suitable for simple as well as combined-cycle cogeneration applications. However, in both the IGCC and the cogeneration plant applications, advanced TES concepts could substantially improve performance and economic benefits. An evaluation of TES options for precooling gas turbine inlet air showed that an ice storage system could be used to effectively increase the peak generating capacity of gas turbines when operating in hot ambient conditions.

2509 Batteries

Refer also to citation(s) 28371

27794 (SAND–94-1244C) **Quartz resonator state-of-charge monitor for lead-acid batteries.** Cernosek, R.W. (Sandia National Labs., Albuquerque, NM (United States)); Martin, S.J.; Wessendorf, K.O.; Rumpf, A.N. Sandia National Labs., Albuquerque, NM (United States). [1994]. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. (CONF-941063–5: 186. meeting of the Electrochemical Society, Miami, FL (United States), 9-14 Oct 1994). Order Number DE94013823. Source: OSTI; NTIS; GPO Dep.

We have demonstrated that a thickness shear mode quartz resonator can be used as a real-time, in situ monitor of the state-of-charge of lead-acid batteries. The resonator is sensitive to hanges in the density and viscosity of the sulfuric acid electrolyte. Both of these liquid parameters vary monotonically with the battery state-of-charge. This new monitor is more precise than sampling hydrometers, and since it is compatible with the Corrosive electrolyte environment, it can be used for in situ monitoring. A TSM resonator consists of gold electrodes deposited on opposite surfaces of a thin AT-cut quartz crystal. When an RF voltage is applied to the electrodes, a shear strain is introduced in the piezoelectric quartz and mechanical resonance occurs between the surfaces. A liquid in contact with one of the quartz surfaces is viscously entrained, which perturbs the resonant frequency and resonance magnitude. If the surface is smooth, the changes in both frequency and magnitude are proportional to $(\rho\eta)^{\frac{1}{2}}$, where ρ is the liquid density and η is the viscosity.

27795 (UCRL-JC–117248) **Regenerative zinc/air and zinc/ferricyanide batteries for stationary power applications.** Cooper, J.F.; Keene, L.E.; Noring, J.; Maimoni, A.; Peterman, K. Lawrence Livermore National Lab., CA (United States). May 1994. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-940670–4: 36. power sources conference, Cherry Hill, NJ (United States), 6-9 Jun 1994). Order Number DE94014734. Source: OSTI; NTIS; GPO Dep.

The authors report a novel configuration for a zinc-particle, packed-bed anode in which an open structure of high hydraulic permeability is maintained indefinitely in a cell with closely spaced walls by the formation of particle bridges and associated gaps. The configuration minimizes electrolyte pumping costs, allows rapid refueling and partial recharge, and provides for 100% zinc consumption. This approach benefits zinc/air fuel batteries by allowing nearly continuous operation and fuel recycle without commercial infrastructure; it benefits $Zn/[Fe(CN)_6]^{-3}$ batteries by eliminating shape-change and polarization problems found with planar anodes.

29 ENERGY PLANNING AND POLICY

27796 (DOE/FTR–94007261) **Travel to Indonesia to assist in the implementation of a renewable energy electrification project: Foreign trip report, May 17–June 2, 1993.** Pate, R.C. Sandia National Labs., Albuquerque, NM (United States). 24 Feb 1994. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. Order Number DE94007261. Source: OSTI; NTIS (US Sales Only); GPO Dep.

Sandia National Laboratories (SNL), under the sponsorship of DOE and the Committee on Renewable Energy, Commerce and Trade (CORECT), provides technical support to industry, and user organizations to expand the use of renewable energy in worldwide markets. The US firm Westinghouse Integrated Power Corporation (EPC/W), together with the Indonesian Agency for the Assessment and Application of Technology (BPPT) and the national electric utility (PLN), requested assistance from SNL in their joint efforts to plan and assess the feasibility for implementation of a renewable energy rural electrification pilot project in the Eastern Outer Islands of Indonesia. The SNL Design Assistance Center (DAC) assisted the IPC/BPPT/PLN team in conducting site surveys, project planning, and feasibility assessment work critical to the establishment of a $20 million project focused on the electrification of approximately 50 rural communities in the outer islands region using renewable energy sources. This effort included the application of GPS/GIS technology in conducting the field surveys and related data analyses, project planning, and assessment.

27797 (DOE/FTR–94008239) **Travel to Mexico as part of ongoing renewable energy project development activities: Foreign trip report, December 6–15, 1993.** Pate, R.C. Sandia National Labs., Albuquerque, NM (United States). [1993]. 21p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. Order Number DE94008239. Source: OSTI; NTIS (US Sales Only); GPO Dep.

A trip to Mexico was made during the period of December 7–15, 1993. The purposes of the trip were: (1) To meet with the Secretariate of Social Development (SEDESOL) and the local Mexico office of the World Bank (World Bank/Mexico) to better define possible cooperation on joint projects and related technical assistance associated with helping insure the inclusion of renewable energy, particularly for water pumping, as part of the second round of World Bank financing for the Regional Development Loan (referred to as Regional Development II) currently being processed; (2) To meet with US-AID/Mexico to coordinate on renewable energy program issues; (3) To meet with state agency and World Wildlife Fund (WWF) personnel in the State of Oaxaca to discuss off-grid productive use renewable energy project opportunities and the steps involved in joint project identification, selection, and development; and (4) To meet with other organizations including CFE, IIE, FIRCO, CONDUMEX and ENTEC to provide updates on the developing AID/DOE program and opportunities for cooperation on project identification and development.

27798 (DOE/FTR–94009138) **US China joint cooperation for the development of renewable energy in China: Foreign trip report, January 23–February 5, 1994.** Stokes, R. (National Renewable Energy Lab., Golden, CO (United States)); Wallace, W.; Tsuo, S.; Siegel, J. National Renewable Energy Lab., Golden, CO (United States). Mar 1994. 34p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC36-83CH10093. Order Number DE94009138. Source: OSTI; NTIS (US Sales Only); GPO Dep.

During January 23 through February 5, 1994, Dr. Robert Stokes, Deputy Director of the National Renewable Energy Laboratory (NREL), Ms. Judith Siegel, acting President of the US Export Council for Renewable Energy (US ECRE), Dr. William Wallace from the Photovoltaics Division of NREL, and Dr. Simon Tsuo from the Basic Sciences Division of NREL visited China to assess the status of renewable energy development in China and express the willingness of the Office of Solar Conversion of the US Department of Energy, the US renewable energy industry, and NREL to cooperate with China in the development and promotion of the use of renewables in China. The trip was exploratory in nature and was conducted in two stages: a series of meetings with key personnel, commissions, ministries, and research institutes in Beijing, and an extended visit to the island province and special economic zone of Hainan to meet with provincial and municipal government leaders and private entrepreneurs on the island to discuss specific project opportunities. The trip resulted in stimulating the interest of the central government in Beijing in developing ties with the US Department of Energy, NREL, and US Renewable Energy companies for promoting renewable energy technology and project development in China. In addition, specific project opportunities were discussed at the provincial level in Hainan.

2901 Energy Analysis and Modeling

Refer also to citation(s) 27239, 27849

2902 Economics and Sociology

Refer also to citation(s) 27378, 27807, 27855, 27856, 28536, 28967

27799 (NEI-DK–1586) **UNEP greenhouse gas abatement costing studies. Phase two: Analysis of abatement costing issues and preparation of a methodology to undertake national greenhouse gas abatement costing studies. Part 1: Main report.** Halsnaes, K.; Mackenzie, G.A.; Christensen, J.M.; Swisher, J.N.; Villavicencio, A. United Nations Environment Programme, Roskilde (Denmark). Collaborating Centre on Energy and Environment. May 1994. 163p. Order Number DE94783310. Source: OSTI; NTIS.

The aim of Phase 2 of the United Nations Environment Programme was to develop consistent guidelines for estimating costs of limiting greenhouse gas emissions and to build up a capacity for their use in developing countries. Brazil, India, Egypt, Thailand, Senegal, Venezuela, Zimbabwe, Denmark, France and the Netherlands were dealt with. Most of these countries expect primary energy consumption to grow more slowly than the Gross Domestic Product so that energy/GDP intensity decreases. Conversely, especially in Brazil and Thailand but not in France or Denmark an increasing intensity of CO_2 intensity of primary consumption in the baseline is expected. Overall, by years 2020/30, CO_2 emissions would be reduced to 2100 million tons corresponding to a 40% reduction in CO_2 from baseline but a tripling of emissions. Country teams estimated abatement cost options for reduction targets from baseline between 12.5-25% in 2005/10 and 30-35% in 2020/30. Cost curves for developing countries exhibit a significant potential for negative cost abatement options, with the exception of Venezuela. The Danish study indicates a substantial negative-cost potential whilst that of both France and the Netherlands is much higher. Achieving short-term and long term targets will result in total annual costs of less than 0.7%. Total abatement costs would be negative for Brazil and Denmark in the short-term and Egypt and Senegal in the long term. In the long-term, average abatement costs for reduction from baseline between 25% and 50% range between 5-37 dollars per ton CO_2. Only France lies outside this range. (AB) (42 refs.)

27800 (NEI-DK–1587) **UNEP greenhouse gas abatement costing studies. Phase two: Analysis of abatement costing issues and preparation of a methodology to undertake national greenhouse gas abatement costing studies. Part 2: Country summaries.** United Nations Environment Programme, Roskilde (Denmark). Collaborating Centre on Energy and Environment. May 1994. 170p. Order Number DE94783311. Source: OSTI; NTIS.

The country studies, which follow the methodological guidelines described in the main report of Phase 2 of the United Nations Environment Programme involving greenhouse gas abatement costing studies, are presented in detail. The countries dealt with are Brazil, Denmark, Egypt, France, India, the Netherlands, Senegal, Thailand, Venezuela and Zimbabwe. The summaries give information under various headings such as current CO_2 emission, the cost of their future limitation, abatement technologies, sensitivity analysis, methodology,and background information such as population, economy, the energy sector etc. (AB)

27801 (NEI-DK–1588) **UNEP greenhouse gas abatement costing studies. Phase two: Analysis of abatement costing issues and preparation of a methodology to undertake national greenhouse gas abatement costing studies. Appendix: Guidelines.** United Nations Environment Programme, Roskilde (Denmark). Collaborating Centre on Energy and Environment. May 1994. 78p. Order Number DE94783312. Source: OSTI; NTIS.

The appendix to the main report of the document of the same title gives the guidelines set up in the process of the carrying out of the United Nations Environment Programme of greenhouse gas abatement costing studies. It is recognized that comparability between assessments in the various countries must be strived for. A common terminology is of the utmost importance, and agreement on basic concepts and definitions, methods, reporting formats and other aspects demand undivided attention. The overall structure demanded of the studies, economic definitions, global and national scenarios, construction of cost curves, the bottom-up and top-down approaches are explained in detail in addition to reporting requirements. (AB) (31 refs.)

27802 (ORNL–6813) **Energy Division annual progress report for period ending September 30, 1993.** Wolff, P.P. (ed.). Oak Ridge National Lab., TN (United States). Jul 1994. 90p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE94016593. Source: OSTI; NTIS; INIS; GPO Dep.

One of 17 research divisions at Oak Ridge National Laboratory, Energy Division's mission is to provide innovative solutions to energy and related issues of national and global importance through interdisciplinary research and development. Its goals and accomplishments are described in this annual progress report for FY1993. Energy Division is committed to (1) understanding the mechanisms by which societies make choices in energy use; (2) improving society's understanding of the environmental, social, and economic implications of technological change; (3) developing and transferring energy-efficient technologies; (4) improving transportation policy and planning; (5) enhancing basic knowledge in the social sciences as related to energy and associated issues. Energy Division's expenditures in FY1993 totaled $42 million. The work was supported by the US DOE, DOD, many other federal agencies, and some private organizations. Disciplines of the 126.5 technical staff members include engineering, social sciences, physical and life sciences, and computer sciences and data systems. The division's programmatic activities cover three main areas: (1) analysis and assessment, (2) energy use and delivery technologies, and (3) transportation systems. Analysis and assessment activities involve energy and resource analysis, preparation of environmental assessments and impact statements, research on emergency preparedness, transportation analysis, and analysis of energy and environmental needs in developing countries. Energy use and delivery technologies focus on electric power systems, building equipment, building envelopes (walls, foundations, roofs, attics, and materials), and methods to improve energy efficiency in existing buildings. Transportation systems research is conducted both to improve the quality of civilian transportation and for sponsors within the US military to improve the efficiency of deployment, scheduling, and transportation coordination.

27803 (PNL–9968) **Work environments and organizational effectiveness: A call for integration.** Heerwagen, J.H.; Heubach, J.G.; Brown, B.W.; Sanchez, J.A.; Montgomery, J.C.; Weimer, W.C. Pacific Northwest Lab., Richland, WA (United States). Jul 1994. 60p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE94016419. Source: OSTI; NTIS; GPO Dep.

In response to a request from the Pacific Northwest Laboratory's Analytical Chemistry Upgrades Program, a team was formed to (1) review work environment and productivity research, (2) report the research in a manner usable to organizational decision-makers, (3) identify Hanford Site facilities examples of the work environment principles and research, and (4) publish the review results in a referred journal. This report summarizes the work environment-organizational effectiveness research reviewed, provides the foundation for a publishable article, and outlines the integration of work environment research and organizational effectiveness in continuing improvement programs and strategic planning. The research cited in this review shows that the physical work environment offers a valuable tool that, used wisely, can contribute significantly to the performance of an organization, its bottom-line economics, and the well-being of all of its employees. This finding leads to one central recommendation: to derive the maximum benefit to the corporation, managers and designers must integrate organizational goals and programs with work environment design. While much of the research cited focuses on office environments, the results and design principles and practices are relevant to a full range of settings: laboratories, schools, hospitals, and factories. The major findings of the research reviewed are summarized below in four areas: (1) performance, (2) well-being, (3) image, and (4) turnover and recruitment.

27804 (SAND–94-1518C) **Sandia scientists enhancing K-12 education: How we've done it and what we've learned.** Eckelmeyer, K.H. Sandia National Labs., Albuquerque, NM (United States). [1994]. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. (CONF-9404192–1: Sigma Xi forum for scientists educators and national standards on action at the local level, Atlanta, GA (United States), 14-15 Apr 1994). Order Number DE94015276. Source: OSTI; NTIS; GPO Dep.

Sandia National Laboratories became seriously involved in the science education reform movement in 1989 in response to a Department of Energy directive: "We must expand our involvement in science education to inspire the youth of American to either enter or feel more comfortable in the fields of math, science and engineering. With our labs and facilities we are uniquely well positioned to provide major assistance in strengthening science and engineering motivation and education, making it 'come alive' for the main body of students who too often fear these disciplines or who cannot relate to them". (Adm. James D. Watkins, U.S. Sec't. of Energy, 9/5/89)

2903 Environment, Health, and Safety

Refer also to citation(s) 27217, 27340, 27341, 27470, 27471, 27472, 27473, 27474, 27503, 27798, 27799, 27800, 27802, 27815, 27816, 27825, 27826, 27855, 27856

27805 (DOE–94016533) **United States Department of Energy Environmental Management Advisory Board: Public meeting.** USDOE Assistant Secretary for Environmental Management, Washington, DC (United States). 15 Jul 1994. 101p. Sponsored by USDOE, Washington, DC (United States). Order Number DE94016533. Source: OSTI; NTIS; GPO Dep.

This meeting of the Environmental Management Advisory Board was held to discuss environmental concerns that everybody has and to provide a strategy for dealing with the problems. Plans for the Environmental Management Programmatic Environmental Impact Statement are presented. A report is included of the subcommittee on institutional barriers to advanced technology use. The subcommittee on environmental restoration cost effectiveness also presents a report. The status of public involvement activities is evaluated. A presentation on the status of spent fuel management is included.

27806 (DOE/EA–0882) **Environmental assessment for the proposed B-Factory (Asymmetric Electron Positron Collider).** USDOE, Washington, DC (United States). Nov 1993. 93p. Sponsored by USDOE, Washington, DC (United States). Order Number DE94015409. Source: OSTI; NTIS; GPO Dep.

This document presents the potential environmental consequences associated with the construction and operation of an Asymmetric Electron Positron Collider, also known as a B-Factory. DOE proposes to modify either the existing Positron-Electron Project at the Stanford Linear Accelerator Center (SLAC) or the Cornell Electron Storage Ring (CESR) at Cornell University. PEP and CESR provide the most technically promising and practical options for a B-Factory. A B-Factory can be constructed by modifying the existing facilities and with minor or no conventional construction. Details involved with the upgrade along with two alternatives to the proposed action are described.

27807 (DOE/EA–0903) **Big George to Carter Mountain 115-kV transmission line project, Park and Hot Springs Counties, Wyoming: Environmental Assessment.** USDOE Western Area Power Administration, Loveland, CO (United States). Loveland Area Office. Feb 1994. 222p. Sponsored by USDOE, Washington, DC (United States). Order Number DE94015411. Source: OSTI; NTIS; GPO Dep.

The Western Area Power Administration (Western) is proposing to rebuild, operate, and maintain a 115-kilovolt (kV) transmission line between the Big George and Carter Mountain Substations in northwest Wyoming (Park and Hot Springs Counties). This environmental assessment (EA) was prepared in compliance with the National Environmental Policy Act (NEPA) and the regulations of the Council on Environmental Quality (CEQ) and the Department of Energy (DOE). The existing Big George to Carter Mountain 69-kV transmission line was constructed in 1941 by the US Department of Interior, Bureau of Reclamation, with 1/0 copper conductor on wood-pole H-frame structures without an overhead ground wire. The line should be replaced because of the deteriorated condition of the wood-pole H-frame structures. Because the line lacks an overhead ground wire, it is subject to numerous outages caused by lightning. The line will be 54 years old in 1995, which is the target date for line replacement. The normal service life of a wood-pole line is 45 years. Under the No Action Alternative, no new transmission lines would be built in the project area. The existing 69-kV transmission line would continue to operate with routine maintenance, with no provisions made for replacement.

27808 (NEI-DK–1589) **Energy 2000 - the followup: Preconditions and calculations.** Energistyrelsen, Copenhagen (Denmark). Nov 1993. 23p. (In Danish). Order Number DE94783302. Source: OSTI; NTIS.

Appendix to "Energi 2000-opfoelgningen".

A summary of the preconditions involved in the production of the Danish Ministry of Energy's publication of "Energi-2000 - opfoelgningen" (Energy 2000 - the followup) wherein specific initiatives are evaluated. A number of the results of calculations made are presented and explained. The text should be studied in relation to the document "Energiudviklingen frem til aar 2005" (Energy development up to the year 2005) published by the same Ministry and produced in relation to the Ministry of Energy's conference of June 14 - 15th, 1993. More detailed descriptions of individual initiatives can be obtained from the Ministry. (AB)

27809 (PNL-SA–24290) **Environmental planning and categorical exclusions: Making the categorical exclusion an integral part of your NEPA tool kit.** Holthoff, M.G.; Hanrahan, T.P. Pacific Northwest Lab., Richland, WA (United States). Jun 1994. 18p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. (CONF-940650–8: 19. annual conference and exposition of the National Association of Environmental Professionals (NAEP): global strategies for environmental issues, New Orleans, LA (United States), 12-15 Jun 1994). Order Number DE94015197. Source: OSTI; NTIS; INIS; GPO Dep.

As contained in the Regulations for Implementing the Procedural Provisions of the National Environmental Policy Act, 40 CFR 1500–1508, the Council on Environmental Quality (CEQ) directs federal agencies to adopt their own procedures for implementing the Act. The US Department of Energy (DOE) and the US Department of Agriculture Forest Service (USFS) are two examples of federal agencies with dissimilar but functionally equivalent CX processes. The DOE and USFS were selected as subjects for this study because of their distinctly different missions and as a results of the author's familiarity with the policies of both agencies. The objectives of this study are to: (1) describe the CX policies and processes of the two agencies, (2) identify the similarities and differences between the two processes, and (3) suggest ways for improving these processes. In performing this evaluation, the authors will identify the components of each agency's CX process that clearly contributes qualitative information for the purpose of making environmental planning decisions. Drawing from the best elements of each process, the authors will provide some general recommendations that should enable the agencies to fulfill their various obligations to the CX process while concurrently performing early, thorough, and expeditious environmental reviews under NEPA.

27810 (SNV–4299) **Life cycle assessment for packagings: Consequence analysis of the Eco Cycle Bill proposition concerning reuse and recycling of packagings.** Swedish Environmental Protection Agency, Solna (Sweden). Mar 1994. 283p. (In Swedish). Order Number DE94783396. Source: OSTI; NTIS.

The Swedish Government have assigned the Swedish Environmental Protection Agency to analyze the consequences of the levels for reuse and materials recycling of packagings, that the government have proposed in the Eco Cycle Bill in 1992. The work have focused on the consequences for the outdoor as well as the indoor environment, cost development, competition conditions, and the development of this issue in other countries

27811 (SNV–4300) **Life cycle assessment for packagings: Calculation of environmental consequences of the Eco Cycle Bill. Life cycle analysis of packagings.** Granath, G. (AaF-Industrins Processkonsult AB, Stockholm (Sweden)); Stroemdahl, I. Swedish Environmental Protection Agency, Solna (Sweden). Mar 1994. 116p. (In Swedish). Order Number DE94783397. Source: OSTI; NTIS.

The aim of this study was to use life cycle analysis for a couple of packaging materials, to investigate if an increased degree of materials recovery is of positive environmental value. Calculations have been performed for packagings of aluminium, steel sheet, plastic, and paper. The results of the life cycle analysis has led to the following conclusions: * The technical possibilities to recycle aluminium and steel packagings are judged good. Recycling leads to decreased energy consumption. * The possibility to recycle plastic packaging are fairly good for pure plastic fractions, but limited if the collected material consists of mixed plastics. A high degree of recycling means environmental advantages through the saving of non-renewable resources. * The technical possibilities to recycle a mixed fraction of paper and cardboard are good. Increased recycling do not lead to any substantial environmental gains. 38 refs, 13 figs, 78 tabs

27812 (SNV–4301) **Life cycle assessment for packagings: Recycling of milk cartons. A LCA-study of differences in environmental load.** Person, L. (Chalmers Industriteknik, Gothenburg (Sweden)); Finnveden, G.; Steen, B. Swedish Environmental Protection Agency, Solna (Sweden). Mar 1994. 119p. (In Swedish). Order Number DE94783398. Source: OSTI; NTIS.

This report concerns the treatment of discarded milk cartons and the environmental impact of the different actions. The alternatives discussed and described are: 1. Combustion and disposal in proportions corresponding to normal Swedish mean values for household wastes. 2. 65% recycling, the rest to combustion and disposal. Replacement fuel, due to reduced waste amount for the district heating networks consists of 50% industrial wastes and 50% mixed wastes corresponding to the average for Sweden. 3. Same as 2 but the substitution fuel is oil. 35 refs

27813 (SNV–4302) **Life cycle assessment for packaging: Economical consequence analysis for the recycling of packagings.** Blidholm, O. (AaF-Energikonsult Stockholm AB (Sweden)); Aakesson, H. Swedish Environmental Protection Agency, Solna (Sweden). Mar 1994. 78p. (In Swedish). Order Number DE94783399. Source: OSTI; NTIS.

The aim of this study has been to calculate the cost of recycling of packagings, and to identify factors of major importance for the final economical result. Decisive factors are the type of source sorting system, the choice of fractions, the method of information, the possibility to motivate the consumers, and the time period after implementation. 42 refs, 2 figs, 37 tabs

2905 Research, Development, Demonstration, and Commercialization

Refer also to citation(s) 27258, 27399, 27592, 27930, 27989, 28106, 28451

27814 (PNL-SA–24444) **Coatings for large-area low-cost solar concentrators and reflectors.** Martin, P.M.; Affinito, J.D.; Gross, M.E.; Bennett, W.D. Pacific Northwest Lab., Richland, WA (United States). Jul 1994. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. (CONF-940723–12: Annual meeting of the Society of Photo-Optical Instrumentation Engineers, San Diego, CA (United States), 24-29 Jul 1994). Order Number DE94015735. Source: OSTI; NTIS; GPO Dep.

Seven years ago, Pacific Northwest Laboratory constructed a large-optics coating facility to develop and fabricate high-performance multilayer laser-mirror coatings on large substrates. With the reduction of DoD funding for the development of optical coatings for large optics, new applications for this chamber were sought. In addition to new DoD applications, the facility is now being used to fabricate multilayer enhanced-metal reflectors for low-cost large-area solar concentrators using both magnetron-sputtered metal and dielectric coatings, with future extension to vacuum-evaporated polymer coatings. Other new applications include: Ti/Ti:Al lamellar composites on flexible webs; EMI cladding for heater wire; EMI-shielding coatings on flexible webs; microwave-absorbing coatings on flexible webs; heat mirrors; bulk micromachining; and protective coatings on cylindrical substrates and webs. The facility has also been established as a DoD user facility for development and experimentation in large-area optical coatings. This paper describes important changes in the large-optics coating chamber and additional deposition equipment that has been added to pursue these new non-DoD technological areas. Solar reflectors and the resulting new coatings will be described. Future work and new technological areas being pursued will also be discussed.

27815 (UCRL-JC–115839) **The Software Technology Center at Lawrence Livermore National Laboratory: Software engineering technology transfer in a scientific R&D laboratory.** Zucconi, L. Lawrence Livermore National Lab., CA (United States). Dec 1993. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-9404185–1: 4. IEEE workshop on software engineering technology transfer, Dallas, TX (United States), 28-29 Apr 1994). Order Number DE94014794. Source: OSTI; NTIS; GPO Dep.

Software engineering technology transfer for productivity and quality improvement can be difficult to initiate and sustain in a non-profit research laboratory where the concepts of profit and loss do not exist. In this experience report, the author discusses the approach taken to establish and maintain a software engineering technology transfer organization at a large R&D laboratory.

27816 (WSRC-TR–94-0328) **Commercial integration and partnering at Savannah River Site.** Steele, J.R. (Westinghouse Savannah River Co., Aiken, SC (United States)); Babione, R.A.; Shikashio, L.A.; Wacaster, A.J.; Paterson, A.D. Westinghouse Savannah River Co., Aiken, SC (United States). Jun 1994. 153p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035. Order Number DE94016694. Source: OSTI; NTIS; GPO Dep.

Savannah River Site (SRS), particularly the Savannah River Technology Center (SRTC) with the experience from the first successful Integrated Technology Demonstration, can provide an excellent foundation for meeting DOE-EM's objectives with the new DOE-EM five focus area approach. With this in mind, SRTC established an activity to pursue full commercialization of environmental technologies. This report is an assessment of the status of commercialization at SRS and provides recommendations for enhancement as well as some tools critical to implementation. A review was made of the current situation at SRS with regards to taking technology development to commercial fruition. This was done from the perspective of comparing it to known commercialization models and processes. It was found that SRTC already works through many of the steps in these processes. With integration and action-oriented efforts of the inclusion of business and market factors, SRTC could become an aggressive, successful developer of commercialized technologies. Commercial success criteria tools were developed with regards to integrating them with SRTC selection criteria to ensure that all critical factors are covered in technology commercialization project evaluations. Private investors are very clear that their interest lies in funding commercial enterprises, not merely technologies. Mobilizing private capital is critical to real job growth and long-term economic development. Also, potential industry partners were identified that are willing to be involved with SRS' technology applications and regional development efforts. As another important component to success, regional support organizations were reviewed and evaluated.

2906 Nuclear Energy

Refer also to citation(s) 27743, 27821, 27823, 28384

27817 (ANL/EA/CP–83307) **Recycling of radioactively contaminated materials: Public policy issues.** Hocking, E.K. Argonne National Lab., IL (United States). [1994]. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-940798–1: Radioactive scrap metal conference,

Knoxville, TN (United States), 12-14 Jul 1994). Order Number DE94015094. Source: OSTI; NTIS; INIS; GPO Dep.

Recycling radioactively contaminated materials requires varying degrees of interaction among Federal regulatory agencies such as the Nuclear Regulatory Commission (NRC) and the Environmental Protection Agency (EPA), State governments and regulators, the public, and the Department of Energy. The actions of any of these parties can elicit reactions from the other parties and will raise issues that must be addressed in order to achieve a coherent policy on recycling. The paper discusses potential actions and reactions of Federal regulatory agencies (defined as NRC and EPA), the States, and the Department and the policy issues they raise.

27818 (DOE-STD–1064-94) **Guideline to good practices for seasonal facility preservation at DOE nuclear facilities.** USDOE, Washington, DC (United States). Jun 1994. 27p. Sponsored by USDOE, Washington, DC (United States). Order Number DE94014954. Source: OSTI; NTIS; GPO Dep.

This guide is intended to assist facility maintenance organizations in the review of existing methods and in the development of new methods for establishing a maintenance Seasonal Facility Preservation program. It is expected that each DOE facility may use approaches or methods different from those defined in this guide. The specific guidelines that follow reflect generally accepted industry practices. Therefore, deviation from any particular guideline would not, in itself, indicate a problem. If substantive differences exist between the intent of this guideline and actual practice, management should evaluate current practice to determine the need to include/exclude proposed features. A change in maintenance practice would be appropriate if a performance weakness were determined to exist. The development, documentation, and implementation of other features that further enhance these guidelines for specific applications are encouraged.

27819 (DOE-STD–1071-94) **Guideline to good practices for material receipt, inspection, handling, storage, retrieval, and issuance at DOE nuclear facilities.** USDOE, Washington, DC (United States). Jun 1994. 29p. Sponsored by USDOE, Washington, DC (United States). Order Number DE94014949. Source: OSTI; NTIS; GPO Dep.

This guide is intended to assist facility maintenance organization in the review of existing methods and in the development of new methods for establishing a material receipt, inspection, handling, storage, retrieval, and issuance process/system which ensures timely delivery of the proper parts and materials, in the condition required for effective maintenance activities, and periodic services which provide unique and/or supplemental maintenance support. It is expected that each DOE facility may use approaches or methods different from those defined in this guide. The specific guidelines that follow reflect generally accepted industry practices. Therefore, deviation from any particular guideline would not, in itself, indicate a problem. If substantive differences exist between the intent of this guideline and actual practice, management should evaluate current practice to determine the meed to include/exclude proposed features. A change in maintenance practice would be appropriate if a performance weakness were determined to exist. The development, documentation, and implementation of other features that further enhance these guidelines for specific applications are encouraged.

27820 (DOE-STD–1072-94) **Guideline to good practices for facility condition inspections at DOE nuclear facilities.** USDOE, Washington, DC (United States). Jun 1994. 51p. Sponsored by USDOE, Washington, DC (United States). Order Number DE94014948. Source: OSTI; NTIS; GPO Dep.

This guide is intended to provide a means for owner/operators to have an awareness of the way business is actually being conducted on the shop floor. Also, this guide is intended to provide a means for maintenance managers to impart their expectations to crafts persons as to how maintenance should be conducted. It is expected that each DOE facility may use different approaches or methods than those defined in this guide. Explanation of the intent of this guide is provided in the Discussion section, and the specific guidelines that follow reflect generally accepted industry practices. In some cases, example situations accompany these guidelines. These examples have been provided only as an aid in clear understanding of the guidelines and should not be construed as the only method for meeting the intent of the guidelines. Therefore, deviation from any particular guideline would not, in itself, indicate a problem. If substantive differences exist between the intent of the Guideline and actual practice, management should evaluate current practice to determine the need to include/exclude proposed features. A change to maintenance practice would be appropriate if a performance weakness was determined to exist. Development, documentation, and implementation of other features which further enhance these guidelines for specific applications, is encouraged.

27821 (KFK–5300) **Scientific papers presented at the festive colloquium on the occasion of the 60th anniversary of Prof. Dr.-Ing. Guenther Kessler.** Kernforschungszentrum Karlsruhe GmbH (Germany). Inst. fuer Neutronenphysik und Reaktortechnik. Feb 1994. 48p. (In German). Order Number DE94786624. Source: OSTI; NTIS (US Sales Only); INIS.

The report presents the three scientific papers: (1) Heads or tails? An all-winning game in KfK/CEA cooperation on fast reactor research. (P.Y. Tanguy). (2) The role and impact of Professor Guenther Kessler in the development of the German Ion Beam Driven Inertial Confinement Fusion Program (G.L. Kulcinski). (3) Concrete under extreme loads - shock waves (J. Eibl. and J. Ockert). (orig./HP)

2920 Supply, Demand, and Forecasting

Refer also to citation(s) 27239, 27832

27822 (DOE/EIA–0035(94/07)) **Monthly energy review, July 1994.** USDOE Energy Information Administration, Washington, DC (United States). Office of Energy Markets and End Use. 26 Jul 1994. 184p. Sponsored by USDOE, Washington, DC (United States). Order Number DE94015819. Source: OSTI; NTIS; GPO; GPO Dep.

Energy production during April 1994 totaled 5.5 quadrillion Btu, a 2.2-percent increase from the level of production during April 1993. Coal production increased 11.8 percent, petroleum production fell 4.0 percent, and natural gas production decreased 0.3 percent. All other forms of energy production combined were down 2.9 percent from the level of production during April 1993. Energy consumption during April 1994 totaled 6.7 quadrillion Btu, 1.4 percent above the level of consumption during April 1993. Petroleum consumption increased 3.9 percent, coal consumption rose 1.1 percent, and natural gas consumption decreased 1.5 percent. Consumption of all other forms of energy combined decreased 0.4 percent from the level 1 year earlier. Net imports of energy during April 1994 totaled 1.5 quadrillion Btu, 8.7 percent above the level of net imports 1 year earlier. Net imports of petroleum increased 4.5 percent, and net imports of natural gas were up 18.5 percent. Net exports of coal fell 9.2 percent from the level in April 1993.

27823 (DOE/EIA–0202(94/3Q)) **Short-term energy outlook: Quarterly projections, Third quarter 1994.** USDOE Energy Information Administration, Washington, DC (United States). Office of Energy Markets and End Use. 2 Aug 1994. 37p. Sponsored by USDOE, Washington, DC (United States). Order Number DE94016711. Source: OSTI; NTIS; GPO Dep.

The Energy Information Administration (EIA) prepares quarterly, short-term energy supply, demand, and price projections for publication in February, May, August, and November in the Short-Term Energy Outlook (Outlook). An annual supplement analyzes the performance of previous forecasts, compares recent cases with those of other forecasting services, and discusses current topics related to the short-term energy markets. (See Short-Term Energy Outlook Annual Supplement, DOE/EIA-0202). The feature article for this issue is Demand, Supply and Price Outlook for Reformulated Gasoline, 1995.

27824 (DOE/EIA–0384(93)) **Annual Energy Review 1993.** USDOE Energy Information Administration, Washington, DC (United States). Office of Energy Markets and End Use. 14 Jul 1994. 404p. Sponsored by USDOE, Washington, DC (United States). Order Number DE94015828. Source: OSTI; NTIS; INIS; GPO; GPO Dep.

This twelfth edition of the Annual Energy Review (AER) presents the Energy Information Administration's historical energy statistics.

For most series, statistics are given for every year from 1949 through 1993. Because coverage spans four and a half decades, the statistics in this report are well-suited to long-term trend analyses. The AER is comprehensive. It covers all major energy activities, including consumption, production, trade, stocks, and prices, for all major energy commodities, including fossil fuels and electricity. The AER also presents Energy Information Administration (EIA) statistics on some renewable energy sources. EIA estimates that its consumption series include about half of the renewable energy used in the United States. For a more complete discussion of EIA's renewables data, see p. xix, "Introducing Expanded Coverage of Renewable Energy Data Into the Historical Consumption Series." Copies of the 1993 edition of the Annual Energy Review may be obtained by using the order form in the back of this publication. Most of the data in the 1993 edition also are available on personal computer diskette. For more information about the diskettes, see the back of this publication. In addition, the data are available as part of the National Economic, Social, and Environmental Data Bank on a CD-ROM. For more information about the data bank, contact the US Department of Commerce Economics and Statistics Administration, on 202-482-1986.

27825 (DOE/EIA–0569(94/2Q)) **EIA Directory of Electronic Products, Second quarter 1994.** National Energy Information Center, Washington, DC (United States). 26 Jul 1994. 77p. Sponsored by USDOE, Washington, DC (United States). Order Number DE94015951. Source: OSTI; NTIS; GPO Dep.

EIA makes available for public use a series of machine-readable data files and computer models, on magnetic tapes; selected data files/models are also available on PC diskettes. The data files include: petroleum, natural gas, electricity, coal, integrated statistics, and consumption. Models include: petroleum, natural gas, electricity, coal, nuclear, and multifuel. On-line files and compact discs include: electronic publishing system, federal bulletin board, economic bulletin board, national trade data bank, national economic/social/environmental data bank, and FedWorld Gateway. For each product listed in this directory, an abstract describes the data published. Contact persons are provided, as are indexes.

2930 Policy, Legislation, and Regulation

Refer also to citation(s) 27403, 27658, 27833

27826 (ORNL/M–3026) **Clean Air Act: Revision 5.** Oak Ridge National Lab., TN (United States). 15 Feb 1994. 1305p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE94015633. Source: OSTI; NTIS; GPO Dep.

This Reference Book contains a current copy of the Clean Air Act, as amended, and those regulations that implement the statute and appear to be most relevant to DOE activities. The document is provided to DOE and contractor staff for informational purposes only and should not be interpreted as legal guidance. This Reference Book has been completely revised and is current through February 15, 1994.

27827 (ORNL/M–3271/R2) **Environmental Regulatory Update Table, May–June 1994.** Houlberg, L.M.; Hawkins, G.T.; Bock, R.E.; Salk, M.S. Oak Ridge National Lab., TN (United States). Jul 1994. 108p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE94015251. Source: OSTI; NTIS; GPO Dep.

The Environmental Regulatory Update Table provides information on regulatory initiatives of interest to DOE operations and contractor staff with environmental management responsibilities. The table is updated bimonthly with information from the Federal Register and other sources, including direct contact with regulatory agencies. Each table entry provides a chronological record of the rulemaking process for that initiative with an abstract and a projection of further action.

2940 Fossil Fuels

Refer also to citation(s) 27251, 27254, 27258, 27821, 27822, 27830

27828 (DOE/FE–0302) **Report to the President on agreements and programs relating to the Naval Petroleum and Oil Shale Reserves.** USDOE Assistant Secretary for Fossil Energy, Washington, DC (United States). Office of Naval Petroleum and Oil Shale Reserves. 1994. 11p. Sponsored by USDOE, Washington, DC (United States). Order Number DE94015888. Source: OSTI; NTIS; GPO Dep.

The Department of Energy monitors commercial natural gas production activities along the boundaries of Naval Oil Shale Reserve No. 1 and Naval Oil Shale Reserve No. 3, which are located in Garfield County, Colorado, and were created in the early part of this century to provide a future source of shale oil for the military. In response to the private sector's drilling of natural gas wells along the south and southwest boundaries of the Reserves, which began in the early 1980's, the Department developed a Natural Gas Protection Program to protect the Government's resources from drainage due to the increasing number of commercial gas wells contiguous to Naval Oil Shale Reserve No. 3. This report provides an update of the Gas Protection Program being implemented and the agreements that have been placed in effect since December 19, 1991, and also includes the one communitized well containing Naval Petroleum Reserve No. 3 lands. The Protection Program employs two methods to protect the Government's resources: (1) sharing with the private sector in the costs and production of wells by entering into "communitization" agreements; and (2) drilling wholly-owned Government wells to "offset" commercial wells that threaten to drain natural gas from the Reserves. The methods designed to protect the Government's resources are achieving their objective of abating gas drainage and migration. As a result of the Protection Program, the Department of Energy is able to produce natural gas and either sell its share on the open market or transfer it for use at Government facilities. The Natural Gas Protection Program is a reactive, ongoing program that is continually revised as natural gas transportation constraints, market conditions, and nearby commercial production activities change.

2960 Electric Power

Refer also to citation(s) 27249, 27789, 27806, 27821, 27822, 27823, 27834

27829 (DOE/BP–2395) **Business plan in brief: Draft.** USDOE Bonneville Power Administration, Portland, OR (United States). Jun 1994. 54p. Sponsored by USDOE, Washington, DC (United States). Order Number DE94015993. Source: OSTI; NTIS; INIS; GPO Dep.

Competition is revolutionizing the electricity industry, and utilities may never be the same. In the past two decades, government deregulation has transformed the airline, cable television, natural gas, and telecommunications industries. Now, with the passage of new laws which have spurred the growth of independent power and opened up transmission access, the electric utility industry has become the laboratory for change. Here in the Northwest, dramatic changes in the electric industry mean that the Bonneville Power Administration (BPA) is facing real competition. Our customers have more choices than they had in the past. BPA's draft Business Plan is a direct response to this changing environment. The plan presents how we propose to adapt to the new competitive marketplace. This is a summary of the plan and some of the important issues it raises for regional discussion. The draft plan contains much more detail on all the topics mentioned here. Business Plan is BPA's first attempt to integrate the long-term strategic plans of the various parts of the agency with a strategic financial plan. Change is evident throughout the plan–change in our operating environment, in our strategic direction, in our customer and constituent relationships, and in BPA itself as an organization.

27830 (DOE/EA–0919) **Final environmental assessment: Sacramento Energy Service Center.** Department of Energy, Sacramento, CA (United States). Western Area Power Administration. Mar 1994. 125p. Sponsored by USDOE, Washington, DC (United States). Order Number DE94015412. Source: OSTI; NTIS; INIS; GPO Dep.

The Sacramento Area Office (SAO) of the Western Area Power Administration (Western) needs to increase the security of operations, to eliminate overcrowding at the current leased location of the existing facilities, to provide for future growth, to improve efficiency, and to reduce operating costs. The proposed action is to construct an approximate 40,000-square foot building and adjacent parking lot with a Solar Powered Electric Vehicle Charging Station installed to promote use of energy efficient transportation. As funding becomes available and technology develops, additional innovative energy-efficient measures will be incorporated into the building. For example the proposed construction of the Solar Powered Electric Vehicle Charging.

27831 (DOE/EIA–0191(93)) **Cost and quality of fuels for electric plants 1993.** USDOE Energy Information Administration, Washington, DC (United States). Office of Coal, Nuclear, Electric and Alternate Fuels. Jul 1994. 178p. Sponsored by USDOE, Washington, DC (United States). Order Number DE94015595. Source: OSTI; NTIS; GPO; GPO Dep.

The Cost and Quality of Fuels for Electric Utility Plants (C&Q) presents an annual summary of statistics at the national, Census division, State, electric utility, and plant levels regarding the quantity, quality, and cost of fossil fuels used to produce electricity. The purpose of this publication is to provide energy decision-makers with accurate and timely information that may be used in forming various perspectives on issues regarding electric power.

27832 (DOE/EIA–0226(94/07)) **Electric power monthly, July 1994.** USDOE Energy Information Administration, Washington, DC (United States). Office of Coal, Nuclear, Electric and Alternate Fuels. Jul 1994. 186p. Sponsored by USDOE, Washington, DC (United States). Order Number DE94015567. Source: OSTI; NTIS; GPO Dep.

The Electric Power Monthly (EPM) presents monthly electricity statistics. The purpose of this publication is to provide energy decisionmakers with accurate and timely information that may be used in forming various perspectives on electric issues that lie ahead. Data in this report are presented for a wide audience including Congress, Federal and State agencies, the electric utility industry, and the general public. The EIA collected the information in this report to fulfill its data collection and dissemination responsibilities as specified in the Federal Energy Administration Act of 1974 (Public Law 93-275) as amended. The EPM is prepared by the Survey Management Division; Office of Coal, Nuclear, Electric and Alternate Fuels, Energy Information Administration (EIA), Department of Energy. This publication provides monthly statistics at the US, Census division, and State levels for net generation, fossil fuel consumption and stocks, quantity and quality of fossil fuels, cost of fossil fuels, electricity sales, revenue, and average revenue per kilowatthour of electricity sold. Data on net generation, fuel consumption, fuel stocks, quantity and cost of fossil fuels are also displayed for the North American Electric Reliability Council (NERC) regions. Statistics by company and plant are published in the EPM on the capability of new generating units, net generation, fuel consumption, fuel stocks, quantity and quality of fuel, and cost of fossil fuels. Data on quantity, quality, and cost of fossil fuels lag data on net generation, fuel consumption, fuel stocks, electricity sales, and average revenue per kilowatthour by 1 month. This difference in reporting appears in the US, Census division, and State level tables. However, for purposes of comparison, plant-level data are presented for the earlier month.

2980 Consumption and Utilization

Refer also to citation(s) 27823

2990 Unconventional Sources and Power Generation

Refer also to citation(s) 27591, 27603, 27801, 27807, 27823

27833 (DOE/OR/00033–T592) **Evaluation of tools for renewable energy policy analysis: The ten federal region model.** Engle, J. Oak Ridge Inst. for Science and Education, TN (United States). Apr 1994. 63p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-76OR00033. Order Number DE94015958. Source: OSTI; NTIS; GPO Dep.

The Energy Policy Act of 1992 establishes a program to support development of renewable energy technologies including a production incentive to public power utilities. Because there is a wide range of possible policy actions that could be taken to increase electric market share for renewables, modeling tools are needed to help make informed decisions regarding future policy. Previous energy modeling tools did not contain the region or infrastructure focus necessary to examine renewable technologies. As a result, the Department of Energy Office of Utility Technologies (OUT) supported the development of tools for renewable energy policy analysis. Three models were developed: The Renewable Energy Penetration (REP) model, which is a spreadsheet model for determining first-order estimates of policy effects for each of the ten federal regions; the Ten Federal Region Model (TFRM), which employs utility capacity expansion and dispatching decision; and the Region Electric Policy Analysis Model (REPAM), which was constructed to allow detailed insight into interactions between policy and technology within an individual region. These Models were developed to provide a suite of fast, personal-computer based policy analysis tools; as one moves from the REP model to the TFRM to the REPAM the level of detail (and complexity) increases. In 1993 a panel was formed to identify model strengths, weaknesses (including any potential biases) and to suggest potential improvements. The panel met in January 1994 to discuss model simulations and to deliberate regarding evaluation outcomes. This report is largely a result of this meeting. This report is organized as follows. It provides a description of the TFRM and summarizes the panel's findings. Individual chapters examine various aspects of the model: demand and load, capacity expansion, dispatching and production costing, reliability, renewables, storage, financial and regulatory concerns, and environmental effects.

27834 (DOE/OR/00033–T593) **Evaluation of tools for renewable energy policy analysis: The renewable energy penetration model.** Engle, J. Oak Ridge Inst. for Science and Education, TN (United States). Apr 1994. 59p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-76OR00033. Order Number DE94015959. Source: OSTI; NTIS; GPO Dep.

The Energy Policy Act of 1992 establishes a program to support development of renewable energy technologies including a production incentive to public power utilities. Because there is a wide range of possible policy actions that could be taken to increase electric market share for renewables, modeling tools are needed to help make informed decisions regarding future policy. Previous energy modeling tools did not contain the regional or infrastructure focus necessary to examine renewable technologies. As a result, the Department of Energy Office of Utility Technologies (OUT) supported the development of tools for renewable energy policy analysis. Three models were developed: The Renewable Energy Penetration (REP) model, which is a spreadsheet model for determining first-order estimates of policy effects for each of the ten federal regions; the Ten Federal Region Model (TFRM), which employs utility capacity expansion and dispatching decisions; and the Regional Electric Policy Analysis Model (REPAM) which was constructed to allow detailed insight into interactions between policy and technology within an individual region. In 1993, the OUT supported the Oak Ridge Institute of Science and Education (ORISE) to form an expert panel to provide an independent review of the REP model and TFRM. This report contains the panel's evaluation of the REP model; the TFRM is evaluated in a companion report. The panel did not review the REPAM. The panel met for a second time in January 1994 to discuss model simulations and deliberate regarding evaluation outcomes. This report is largely a result of this second meeting. The remainder of this chapter provides a description of the REP model and summarizes the panel's findings. Individual chapters examine various aspects of the model: demand and load, capacity expansion, dispatching and production costing, reliability, renewables, storage, transmission, financial and regulatory concerns, and environmental effects.

27835 (ORNL–6775/V1) **The integration of renewable energy sources into electric power distribution systems: Volume 1: National assessment.** Barnes, P.R. (Oak Ridge National Lab.,

TN (United States)); Van Dyke, J.W.; Tesche, F.M.; Zaininger, H.W. Oak Ridge National Lab., TN (United States). Jun 1994. 84p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE94015935. Source: OSTI; NTIS; GPO Dep.

Renewable energy technologies such as photovoltaic, solar thermal electricity, and wind turbine power are environmentally beneficial sources of electric power generation. The integration of renewable energy sources into electric power distribution systems can provide additional economic benefits because of a reduction in the losses associated with transmission and distribution lines. Benefits associated with the deferment of transmission and distribution investment may also be possible for cases where there is a high correlation between peak circuit load and renewable energy electric generation, such as photovoltaic systems in the Southwest. Case studies were conducted with actual power distribution system data for seven electric utilities with the participation of those utilities. Integrating renewable energy systems into electric power distribution systems increased the value of the benefits by about 20 to 55% above central station benefits in the national regional assessment. In the case studies presented in Vol. II, the range was larger: from a few percent to near 80% for a case where costly investments were deferred. In general, additional savings of at least 10 to 20% can be expected by integrating at the distribution level. Wind energy systems were found to be economical in good wind resource regions, whereas photovoltaic systems costs are presently a factor of 2.5 too expensive under the most favorable conditions.

30 DIRECT ENERGY CONVERSION

3001 MHD Generators

27836 (DOE/PC/90350–T5) **DC CICC retrofit magnet preliminary design, protection analysis, and software development: Final report.** Marston, P.G. Massachusetts Inst. of Tech., Cambridge, MA (United States). Plasma Fusion Center. 28 Apr 1994. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG22-90PC90350. Order Number DE94017112. Source: OSTI; NTIS; GPO Dep.

The MIT Plasma Fusion Center magnet technology development effort, in support of the DOE/PETC MHD program, has culminated in two recent innovations which, when combined, will not only improve the reliability of commercial scale MHD magnets but will also reduce their cost by a factor of two. The first of these is a new form of Cable In Conduit Conductor (CICC) designed specifically for large scale DC superconducting magnets and the second is a highly efficient, quasi-momentless force containment which is made possible by the new conductor.

32 ENERGY CONSERVATION, CONSUMPTION, AND UTILIZATION

Refer also to citation(s) 27801

3201 Buildings

Refer also to citation(s) 27610, 27634

27837 (DOE/EA–0923) **Environmental Assessment: Winnett School District Boiler Replacement Project.** USDOE Assistant Secretary for Environment, Safety, and Health, Washington, DC (United States). [1994]. 40p. Sponsored by USDOE, Washington, DC (United States). Order Number DE94015410. Source: OSTI; NTIS; GPO Dep.

This environmental assessment analyzes the environmental impacts of replacing the Winnett School District complex's existing oil-fired heating system with a new coal-fired heating system with funds provided from a grant under the Institutional Conservation Program. This Assessment has been prepared in accordance with the provisions of the National Environmental Policy Act (NEPA), the Council on Environmental Quality's regulations; the Department's Implementing Procedures and Guidelines Revocation; and the May 1993 "Recommendations for the Preparation of Environmental Assessments and Environmental Impact Statements," by the Department's Office of NEPA Oversight. Under the Institutional Conservation Programs, created by the National Energy Conservation Policy Act (PL 95–619), the Department is authorized to encourage energy conservation-by providing funding for up to 50 percent of the costs of installation of qualified energy conservation measures by entities such as schools, hospitals, and other buildings owned by local governments. This proposed action to fund partially the installation of a new coal-fired heating system for the Winnett School District is part of this energy conservation program.

27838 (DOE/EE–0009-Vol.3) **Technical support document: Energy efficiency standards for consumer products: Room air conditioners, water heaters, direct heating equipment, mobile home furnaces, kitchen ranges and ovens, pool heaters, fluorescent lamp ballasts and television sets: Volume 3, Water heaters, pool heaters, direct heating equipment, and mobile home furnaces.** USDOE Assistant Secretary for Energy Efficiency and Renewable Energy, Washington, DC (United States). Office of Codes and Standards. Nov 1993. 555p. Sponsored by USDOE, Washington, DC (United States). Order Number DE94006577. Source: OSTI; NTIS; GPO Dep.

This is Volume 3 in a series of documents on energy efficiency of consumer products. This volume discusses energy efficiency of water heaters. Water heaters are defined by NAECA as products that utilize oil, gas, or electricity to heat potable water for use outside the heater upon demand. These are major appliances, which use a large portion (18% on average) of total energy consumed per household (1). They differ from most other appliances in that they are usually installed in obscure locations as part of the plumbing and are ignored until they fail. Residential water heaters are capable of heating water up to 180°F, although the setpoints are usually set lower.

27839 (LBL–33192) **Modeling windows in DOE-2.1E.** Reilly, M.S. (Enermodal Engineering, Inc., Denver, CO (United States)); Winkelmann, F.C.; Arasteh, D.K.; Carroll, W.L. Lawrence Berkeley Lab., CA (United States). Dec 1992. 19p. Sponsored by USDOE, Washington, DC (United States);Gas Research Inst., Chicago, IL (United States);Organization for Economic Co-Operation and Development, 75 - Paris (France). International Energy Agency;Electric Power Research Inst., Palo Alto, CA (Unite DOE Contract AC03-76SF00098. (TA–308; CONF-921203–13: Thermal performance of the exterior envelopes of buildings, Clearwater, FL (United States), 7-10 Dec 1992). Order Number DE94014962. Source: OSTI; NTIS; GPO Dep.

The most recent version of the DOE-2 building energy simulation program, DOE-2.1E, provides for more detailed modeling of the thermal and optical properties of windows. The window calculations account for the temperature effects on U-value, and update the incident angle correlations for the solar heat gain properties and visible transmittance. Initial studies show up to a 35% difference in calculating peak solar heat gain between the detailed approach and a constant shading-coefficient approach. The modeling approach is adapted from Lawrence Berkeley Laboratory's WINDOW 4 computer program, which is used in the National Fenestration Rating Council (NFRC) U-value rating procedure 100-91. This gives DOE-2.1E the capability to assess the annual and peak energy performance of windows consistent with the NFRC procedure. The program has an extensive window library and algorithms for simulating switchable glazings. The program also accounts for the influence of framing elements on the heat transfer and solar heat gain through the window.

27840 (LBL–33906) **Recent improvements in SPARK: Strong component decomposition, multivalued objects, and graphical interface.** Buhl, W.F. (Lawrence Berkeley Lab., CA (United States). Energy and Environmental Div.); Erdem, A.E.; Winkelmann, F.C.; Sowell, E.F. Lawrence Berkeley Lab., CA (United States). Aug 1993. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00098. (CONF-9308111–2: 3. international conference of the International Building Performance Simulation Association, Adelaide (Australia), 16-18 Aug 1993). Order Number DE94014968. Source: OSTI; NTIS; GPO Dep.

The Simulation Problem Analysis Research Kernel (SPARK) environment for simulation of nonlinear differential algebraic systems has been revised to improve modeling convenience, modeling flexibility, and solution efficiency. Solution efficiency has been enhanced by automatic decomposition of the problem into strongly connected components, characterized as separately solvable subproblems. The normally constructed data flow graph in SPARK allows such components to be identified and placed in the correct order for sequential solution resulting in significant speed-up for problems that are not strongly interconnected. Modeling flexibility has been enhanced by adding the Multivalued Objects. Whereas conventional SPARK objects represent single equations and produce a single result, this extension allows more complex objects which themselves solve simultaneous sets of equations for multiple results. The need for such objects arises when submodels are to be solved independently of the spark solver; e.g., to use a specially tailored algorithm. With regard to modeling convenience, the graphical user interface now allows model definition by selection and placement of object icons in a graphical window in an X-windows environment. These objects can be connected with macro links comprising multiple problem variables. The resulting problem is then translated into a Network Language Specification file for SPARK processing.

27841 (LBL–34271) **A validation of the WINDOW4/FRAME3 linear interpolation methodology.** Beck, F.A.; Arasteh, D. Lawrence Berkeley Lab., CA (United States). Aug 1993. 14p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00098. (CONF-940104–8: Winter meeting of the American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE), New Orleans, LA (United States), 22-26 Jan 1994). Order Number DE94014960. Source: OSTI; NTIS; GPO Dep.

The validity of a method to reduce the total number of computer simulations which must be run to determine the U-values of a window product line with multiple glazing options is examined. The accuracy and limits of this method, which uses the WINDOW4 and FRAME simulation programs, is evaluated by comparing the edge, frame, and total window U-values calculated on the basis of single point FRAME simulations to those U-values as calculated on the basis of four point FRAME simulations combined with linear interpolation of frame and edge U-values by WINDOW4. The accuracy of this procedure is examined for two frame types, a low thermal conductivity wood-framed casement and a high thermal conductivity aluminum-framed casement, using both aluminum spacers and insulating spacers over a wide range of glazing types. The effect of center-of-glass U-value, overall glazing thickness and spacer type on frame and edge-of-glass U-values is discussed. It is shown that the agreement between total window U-values as calculated by the single point and four point simulation methods is better than 1% for double and triple-glazed windows with aluminum spacers, better than 1% for double-glazed windows with insulating spacers, and better than 2% for triple-glazed windows with insulating spacers.

27842 (LBL–34715) **A new method for predicting the solar heat gain of complex fenestration systems: 1, Overview and derivation of the matrix Layer calculation.** Klems, J.H. Lawrence Berkeley Lab., CA (United States). Oct 1993. 14p. Sponsored by USDOE, Washington, DC (United States);American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc., Atlanta, GA (United States). DOE Contract AC03-76SF00098. (CONF-940104–9: Winter meeting of the American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE), New Orleans, LA (United States), 22-26 Jan 1994). Order Number DE94014915. Source: OSTI; NTIS; GPO Dep.

A new method of predicting the solar heat gain through complex fenestration systems involving nonspecular layers such as shades or blinds has been examined in a project jointly sponsored by ASHRAE and DOE. In this method, a scanning radiometer is used to measure the bidirectional radiative transmittance and reflectance of each layer of a fenestration system. The properties of systems containing these layers are then built up computationally from the measured layer properties using a transmission/multiple-reflection calculation. The calculation produces the total directional-hemispherical transmittance of the fenestration system and the layer-by-layer absorptances. These properties are in turn combined with layer-specific measurements of the inward-flowing fractions of absorbed solar energy to produce the overall solar heat gain coefficient. In this first in a series of related papers describing the project, the assumptions and limitations of the calculation method are described and the derivation of the matrix calculation technique from the initial integral equations is presented.

27843 (LBL–34717) **Measurement of the exterior convective film coefficient for windows in low-rise buildings.** Yazdanian, M. (Lawrence Berkeley Lab., CA (United States). Energy and Environmental Div.); Klems, J.H. Lawrence Berkeley Lab., CA (United States). Oct 1993. 19p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00098. (CONF-940104–10: Winter meeting of the American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE), New Orleans, LA (United States), 22-26 Jan 1994). Order Number DE94014970. Source: OSTI; NTIS; GPO Dep.

The MoWiTT field facility is used to measure the convective film coefficient over the exterior surface of a window. The MoWiTT-measured data is compared to some commonly-used experimental and theoretical models. The comparison shows that the MoWiTT data disagrees with the previously used models such as the ASHRAE/DOE-2 model. The reasons for these disagreements are discussed. An experimental model, based on the MoWiTT data, is presented to correlate the film coefficient with the difference in temperatures of the exterior glass surface and the ambient, in the natural convection region, and with the site wind speed, in the forced convection region. The wind speed is considered both in windward and leeward hemispheres. The validity of the MoWiTT model for low-rise buildings is then discussed.

27844 (LBL–35253) **Developing practical reflectors for cylindrical and compact fluorescent lamps based on nonimaging optics.** Packer, M.; Rubinstein, F. Lawrence Berkeley Lab., CA (United States). Aug 1993. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00098. (CONF-9310285–2: Institute of Electrical and Electronic Engineers-Industry Applications Society (IEEE-IAS) annual meeting, Ontario (Canada), 2-8 Oct 1993). Order Number DE94014925. Source: OSTI; NTIS; GPO Dep.

This paper investigates the application of nonimaging concentrators to the design of reflectors for luminaires. An interpretation of the concentration ratio – a statement of the conservation of flux – relative to the properties of a source and reflector is given. The result is used to develop practical compound parabolic (CP) reflector geometries that accommodate modern lamps. For the cylindrical and compact fluorescent lamps, we use the concentration ratio to show how the size and output performance of the CP reflector can be improved relative to the luminous and geometric properties of the lamp. The paper concludes by considering the addition of a nonimaging louver as a potentially significant design step once the reflector has been suitably designed relative to the lamp. It is noted that accurate data on the luminous emitting properties of lamps is a prerequisite to the development of optimum compact reflector designs.

27845 (LBL–35256) **Variations in convective venting to increase the efficiency of compact fluorescent downlights.** Siminovitch, M.; Zhang, C.; Kleinsmith, N. Lawrence Berkeley Lab., CA (United States). Jul 1993. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00098. (CONF-9310285–3: Institute of Electrical and Electronic Engineers-Industry Applications Society (IEEE-IAS) annual meeting, Ontario (Canada), 2-8 Oct 1993). Order Number DE94014911. Source: OSTI; NTIS; GPO Dep.

In most compact fluorescent recessed downlights, hot air stratifies within the fixture, causing the lamps to overheat and lose up to 25% of light output and efficacy. Thermal management techniques, including passive venting of the fixture, are being developed to mitigate these losses in fixture efficiency. This paper demonstrates a sequence of venting configurations and techniques, from an unmodified compact fluorescent downlight as a control fixture, through a series of venting strategies, to the development of a highly efficient downlight that incorporates a new angular concept in convective venting. With this new venting design, an increase in

light output of nearly 25% can be attained without the optical losses generally associated with some venting geometries.

27846 (LBL–35382-Rev.) **Simulating the energy performance of holographic glazings.** Papamichael, K.; Beltran, L.; Furler, R.; Lee, E.S.; Selkowitz, S.; Rubin, M. Lawrence Berkeley Lab., CA (United States). May 1994. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00098. (CONF-9404167–1-Rev.: SPIE 13: international symposium on optical materials technology for energy efficiency and solar energy conversion, Freiburg (Germany), 18-22 Apr 1994). Order Number DE94014969. Source: OSTI; NTIS; GPO Dep.

The light diffraction properties of holographic diffractive structures present an opportunity to improve the daylight performance in sidelit office spaces by redirecting and reflecting sunlight off the ceiling, providing adequate daylight illumination up to 9 m from the window wall. Prior studies of prototypical holographic glazings, installed above conventional windows, have shown increased daylight levels over a deeper perimeter area than clear glass, for selected sun positions. In this study, we report on the simulation of the energy performance of prototypical holographic glazings assuming a commercial office building, in the inland Los Angeles climate. The simulation of the energy performance involved determination of both luminous and thermal performance. Since the optical complexity of holographic glazings prevented the use of conventional algorithms for the simulation of their luminous performance, we used a new method that combines experimentally determined directional workplane illuminance coefficients with computer-based analytical routines to determine a comprehensive set of daylight factors for many sun positions. These daylight factors were then used within the DOE-2.1D energy simulation program to determine hourly daylight and energy performance over the course of an entire year for four window orientations. Since the prototypical holographic diffractive structures considered were applied on single pane clear glass, we also simulated the performance of hypothetical glazings, assuming the daylight performance of the prototype holographic glazings and the thermal performance of double-pane and low-e glazings. Our analyses show that these prototypical holographic glazings did not save significant electric energy or reduce peak electricity demand compared to conventional energy-efficient window systems, mainly because of their low diffraction efficiency. Finally, we address design and implementation issues towards potential performance improvement.

27847 (ORNL/CON–363) **Analysis of savings due to multiple energy retrofits in a large office building.** McLain, H.A.; Leigh, S.B.; MacDonald, J.M. Oak Ridge National Lab., TN (United States). May 1994. 97p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE94015961. Source: OSTI; NTIS; GPO Dep.

The objective of this analysis was to characterize the benefits of the individual energy conservation measures that were applied to an existing large office building. The measures included those for lighting; those for the heating, ventilation, and air conditioning (HVAC) systems; and an energy management and control system (EMCS). The purpose was to improve our understanding of the impacts of the individual measures in contrast to the entire group of measures that were installed during a building improvement project. The scope of the study was primarily analytical; it used an hourly building simulation model to estimate the benefits. Input parameters for this model were adjusted so that the calculated results matched closely with the available monthly electrical billing data. Supplemental building energy use data were collected and used to improve the adjustment of these parameters. The benefits of the individual measures were then calculated using the matched model.

27848 (ORNL/CON–380) **Assessment of technologies for constructing self-drying low-slope roofs.** Kyle, D.M.; Desjarlais, A.O. Oak Ridge National Lab., TN (United States). May 1994. 135p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE94015527. Source: OSTI; NTIS; GPO Dep.

Issues associated with removing excessive moisture from low-slope roofs have been assessed. The economic costs associated with moisture trapped in existing roofs have been estimated. The evidence suggests that existing moisture levels cause approximately a 40% overall reduction in the R-value of installed roofing insulation in the United States. Excess operating costs are further increased by a summertime heat transfer mode unique to wet insulation, caused by the daily migration of water within the roof. By itself, this effect can increase peak electrical demand for air conditioning by roughly 15 W/m^2 of roofing, depending on the type of insulation. This effect will increase peak demand capacity required of utilities in any geographic region (e.g., 900 MW in the South). A simple formula has been derived for predicting the effect that self-drying roofs can have upon time-averaged construction costs. It is presumed that time-averaged costs depend predominantly upon (1) actual service life and (2) the likelihood that the less expensive recover membranes can be installed safely over old roofs. For example, an increase in service life from 15 to 20 years should reduce the current cost of roofing ($12 billion/year) by 21%. Another simple formula for predicting the reroofing waste volume indicates that an increase in service life from 15 to 20 years might reduce the current estimated 0.4 billion ft^3/year of waste by 25%. A finite-difference computer program has been used to study the flow of heat and moisture within typical existing roofs for a variety of US climates. Nearly all publicly available experimental drying data have been consulted. The drying times for most existing low-slope roofs in the United States are controlled largely climate and the permeability of the structural deck to water vapor.

27849 (ORNL/Sub–91-SL794) **Literature survey of heat transfer enhancement techniques in refrigeration applications.** Jensen, M.K. (Rensselaer Polytechnic Inst., Troy, NY (United States). Dept. of Mechanical Engineering, Aeronautical Engineering and Mechanics); Shome, B. Oak Ridge National Lab., TN (United States); Rensselaer Polytechnic Inst., Troy, NY (United States). Dept. of Mechanical Engineering, Aeronautical Engineering and Mechanics. May 1994. 306p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE94016782. Source: OSTI; NTIS; GPO Dep.

A survey has been performed of the technical and patent literature on enhanced heat transfer of refrigerants in pool boiling, forced convection evaporation, and condensation. Extensive bibliographies of the technical literature and patents are given. Many passive and active techniques were examined for pure refrigerants, refrigerant-oil mixtures, and refrigerant mixtures. The citations were categorized according to enhancement technique, heat transfer mode, and tube or shell side focus. The effects of the enhancement techniques relative to smooth and/or pure refrigerants were illustrated through the discussion of selected papers. Patented enhancement techniques also are discussed. Enhanced heat transfer has demonstrated significant improvements in performance in many refrigerant applications. However, refrigerant mixtures and refrigerant-oil mixtures have not been studied extensively; no research has been performed with enhanced refrigerant mixtures with oil. Most studies have been of the parametric type; there has been inadequate examination of the fundamental processes governing enhanced refrigerant heat transfer, but some modeling is being done and correlations developed. It is clear that an enhancement technique must be optimized for the refrigerant and operating condition. Fundamental processes governing the heat transfer must be examined if models for enhancement techniques are to be developed; these models could provide the method to optimize a surface. Refrigerant mixtures, with and without oil present, must be studied with enhancement devices; there is too little known to be able to estimate the effects of mixtures (particularly NARMs) with enhanced heat transfer. Other conclusions and recommendations are offered.

27850 (PNL–9820) **Energy efficiency assessment methods and tools evaluation.** McMordie, K.L.; Richman, E.E.; Keller, J.M.; Dixon, D.R. Pacific Northwest Lab., Richland, WA (United States). Aug 1994. 119p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE94016811. Source: OSTI; NTIS; GPO Dep.

Many different methods of assessing the energy savings potential at federal installations, and identifying attractive projects for capital investment have been used by the different federal agencies. These methods range from high-level estimating tools to

detailed design tools, both manual and software assisted. These methods have different purposes and provide results that are used for different parts of the project identification, and implementation process. Seven different assessment methods are evaluated in this study. These methods were selected by the program managers at the DoD Energy Policy Office, and DOE Federal Energy Management Program (FEMP). Each of the methods was applied to similar buildings at Bolling Air Force Base (AFB), unless it was inappropriate or the method was designed to make an installation-wide analysis, rather than focusing on particular buildings. Staff at Bolling AFB controlled the collection of data.

27851 (PNL-SA-23225) **A three-story prototype commercial building model for energy standard development and assessment.** Jarnagin, R.E. Pacific Northwest Lab., Richland, WA (United States). Jun 1994. 17p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. (CONF-9406105–2: 1994 American Society of Heating, Refrigerating, and Air Conditioning Engineers (ASHRAE) summer meeting, Orlando, FL (United States), 25-29 Jun 1994). Order Number DE94015199. Source: OSTI; NTIS; GPO Dep.

Annual hourly simulation programs are generally used in the development and assessment of the impacts of building energy standards. These simulation programs require the specification of a building model as input to the simulation. Results of the simulations are sensitive to the building model, so care must be taken in the choice of the model to ensure representative results. A three-story prototype commercial building model is being used in developing requirements for the revision of ASHRAE Standard 90.1. The prototype is generic but has the capability to represent a broad range of commercial building types, sizes, orientations, and aspect ratios.

27852 (SAND–94-1552C) **Geothermal Heat Pump research and development studies at Sandia National Laboratories.** Martinez, G.M.; Sullivan, W.N. Sandia National Labs., Albuquerque, NM (United States). [1994]. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. (CONF-940812–17: 29. intersociety energy conversion engineering conference, Monterey, CA (United States), 7-12 Aug 1994). Order Number DE94015775. Source: OSTI; NTIS; GPO Dep.

The Geothermal Heat Pump (GHP) concept was originally developed in the 1940's. Recently, because of increasing energy costs, utility interest, and the development of simple and durable ground source heat exchangers, GHP's have gained international attention as a proven means of energy conservation and electrical peak power demand reduction. GHP systems require installation of a buried heat exchanger to utilize the nearly constant ground temperature making them more efficient than conventional air source heat pumps. However, the high installation cost for both residential and commercial applications is a major obstacle to their market penetration. Sandia National Laboratories (SNL) through its sponsors, the Department of Energy (DOE), and the Department of Defense (DOD), has embarked on a research program to find ways to reduce GHP installation costs and improve performance, thereby increasing their market penetration. The major elements of the program are: data acquisition to quantify the performance of GHP'S, research and development (R&D) of the ground source heat exchanger aimed at reducing, installation costs, and support of DOE efforts to market the GHP concept. This paper describes the current status of our program, some experimental and analytical results, and plans for future activities.

27853 (SR/EMEU–94-01) **Reducing home heating and cooling costs.** USDOE Energy Information Administration, Washington, DC (United States). 1 Jul 1994. 28p. Sponsored by USDOE, Washington, DC (United States). Order Number DE94015395. Source: OSTI; NTIS; GPO; GPO Dep.

This report is in response to a request from the House Committee on Energy and Commerce that the Energy Information Administration (EIA) undertake a neutral, unbiased analysis of the cost, safety, and health and environmental effects of the three major heating fuels: heating oil, natural gas, and electricity. The Committee also asked EIA to examine the role of conservation in the choice of heating and cooling fuel. To accommodate a wide audience, EIA decided to respond to the Committee's request in the context of a report on reducing home heating and cooling costs. Accordingly, this report discusses ways to weatherize the home, compares the features of the three major heating and cooling fuels, and comments on the types of heating and cooling systems on the market. The report also includes a worksheet and supporting tables that will help in the selection of a heating and/or cooling system.

27854 (WHC-SA–2313) **Evaluation of self-contained HEPA filter.** Arndt, T.E. Westinghouse Hanford Co., Richland, WA (United States). Jun 1994. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-940738–4: 23. DOE/NRC nuclear air cleaning and treatment conference, Buffalo, NY (United States), 25-28 Jul 1994). Order Number DE94015709. Source: OSTI; NTIS; GPO Dep.

This paper presents the results of an evaluation of a self-contained high-efficiency particulate air filter (SCHEPA) used in nuclear applications. A SCHEPA consists of filter medium encapsulated in a casing that is part of the system boundary. The SCHEPA filter serves as a combination of filter housing and filter. The filter medium is attached directly to the casing using adhesive as a bonding agent. A cylindrical connection in the middle of the end caps connects the filter assembly to adjoining ductwork. The SCHEPA must perform the functions of a filter housing, filter frame, and filter. It was recognized that the codes and standards do not address the SCHEPA specifically. Therefore, the investigation evaluated the SCHEPA against current codes and standards related to the functional requirements of an air-cleaning system. The specific standards used are required by DOE Order 6430.1A and include ASME N509, ASME N510, ERDA 76-21, MIL-F-51068F, NFPA 90A, and NFPA 91. The evaluation does not address whether the SCHEPA as a standard (off-the-shelf) filter could be upgraded to meet the current code requirements for an air-cleaning unit. The evaluation also did not consider how the SCHEPA was used in a system (e.g., whether it was under positive or negative pressure or whether it served as an air inlet filter to prevent contamination releases under system pressurization). The results of the evaluation show that, the SCHEPA filter does not meet design, fabrication, testing, and documentation requirements of ASME N509 and ASME N510. The paper will identify these deficiencies. Specific exhaust system requirements and application should be considered when an evaluation of the SCHEPA filter is being performed in existing systems. When new designs are being contemplated, other types of HEPA filter housings can be used in lieu of the SCHEPA filter.

3202 Transportation

Refer also to citation(s) 28360

27855 (CONF-941086–2) **Feasibility of a driver performance data acquisition system.** Carter, R.J. (Oak Ridge National Lab., TN (United States)); Spelt, P.F.; Goodman, M.J. Oak Ridge National Lab., TN (United States). [1994]. 11p. Sponsored by Department of Transportation, Washington, DC (United States). DOE Contract AC05-84OR21400. From 38. annual meeting of the Human Factors and Ergonomics Society; Nashville, TN (United States); 24-28 Oct 1994. Order Number DE94012327. Source: OSTI; NTIS; GPO Dep.

The National Highway Traffic Safety Administration (NHTSA) envisions many future situations in which the effectiveness and consequences of new intelligent vehicle-highway systems technologies will need to be studied in actual production vehicles. Such studies will enable evaluations in vehicles which are familiar to drivers. These studies would be future enhanced by the availability of an instrumentation package that can be easily installed in these vehicles to enable specific vehicle configurations of interest to be evaluated, thereby increasing the variety of vehicle options that are available for study. Ideally, an approach is needed that would allow data collection from a variety of vehicle models and types, and would address the issue of driver familiarity. Such an approach is embodied in the concept of a driver performance data acquisition system that could be installed in a wide range of vehicles within a relatively short period of time. As a universally adaptable system, it would provide researchers with the ability to manually input data as well as directly record information on driver, vehicle, roadway, and environmental parameters. Furthermore, it would enable the measurement of driver performance in the driver's own vehicle, thereby

ensuring vehicle familiarity. In addition, it would be possible to measure driver performance in relation to any vehicle design characteristic at relatively little expense and effort, and would make it easy to update existing models of driver/vehicle behavior to reflect performance characteristics in vehicles of current manufacture.

27856 (DOE/PO–0021) **Energy, emissions, and social consequences of telecommuting: Technical Report One.** USDOE Assistant Secretary for Policy, Planning and Program Evaluation, Washington, DC (United States). [1994]. 112p. Sponsored by USDOE, Washington, DC (United States). Order Number DE94013377. Source: OSTI; NTIS; GPO Dep.

By reducing transportation use, telecommuting can help reduce some of the social costs of travel (traffic congestion, time lost, emissions, dependence on imported fuels, accident deaths and property damage). These positive direct effects will be both offset and supplemented by indirect effects of telecommuting: improved traffic flow, latent demand (people will start driving more), and increased urban sprawl. The study indicates that the energy and emissions benefits of telecommuting are not likely to be entirely offset by latent travel demand or by the geographical expansion of cities; perhaps half the potential reduction in vehicle-miles traveled will be replaced by new traffic. From a fuel-use perspective, the indirect benefit of lower average emissions and fuel consumption rates appears sufficient to offset impacts from the third indirect effect, additional travel brought about by increased suburbanization. Substantial levels of telecommuting will also reduce the need for highway capacity expansion, saving capital, maintenance, and urban land. Telecommuting and its benefits will be concentrated in the largest, most congested, and most polluted urban areas (20–25% in the NYC and LA areas; 50% in the 10 largest cities; 90% in the 75 largest).Telecommuting may also have a synergistic beneficial effect on other transportation strategies, e.g., congestion pricing, parking fees, taxes discouraging travel during peak periods, etc. Other beneficial effects may include greater presence of adults at home and on residential communities. Effects of improved telecommunications technology on transportation, freight, economy, industrial operations are discussed, including implications of an "information superhighway."

27857 (DOE/PO–0026) **Energy, emissions, and social consequences of telecommuting: Energy efficiency in the US economy: Technical report one.** USDOE Assistant Secretary for Policy, Planning and Program Evaluation, Washington, DC (United States). Jun 1994. 112p. Sponsored by USDOE, Washington, DC (United States). Order Number DE94014300. Source: OSTI; NTIS; GPO Dep.

See report DOE/PO–0021.

27858 (ORNL–6798) **Transportation Energy Data Book: Edition 14.** Davis, S.C. Oak Ridge National Lab., TN (United States). May 1994. 310p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE94015723. Source: OSTI; NTIS; GPO Dep.

Designed for use as a desk-top reference, the data book represents an assembly and display of statistics and information that characterize transportation activity, and presents data on other factors that influence transportation energy use. The purpose of this document is to present relevant statistical data in the form of tables and graphs. Each of the major transportation modes is treated in separate chapters or sections. Chapter 1 compares US transportation data with data from other countries. Aggregate energy use and energy supply data for all modes are presented in Chapter 2. The highway mode, which accounts for over three-fourths of total transportation energy consumption, is dealt with in Chapter 3. Topics in this chapter include automobiles, trucks, buses, fleet vehicles, federal standards, fuel economies, and high-occupancy vehicle lane data. Household travel behavior characteristics are displayed in Chapter 4. Chapter 5 contains information on alternative fuels and alternatively-fueled vehicles. Chapter 6 covers the major nonhighway modes: air, water, and rail. The last chapter, Chapter 7, presents data environmental issues relating to transportation.

27859 (ORNL/TM–12773) **Concept definition of traffic flow wide-area surveillance.** Allgood, G.O.; Ferrell, R.K.; Kercel, S.W. Oak Ridge National Lab., TN (United States). Jul 1994. 40p. Sponsored by Federal Highway Administration, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE94015660. Source: OSTI; NTIS; GPO Dep.

Traffic management can be thought of as a stochastic queuing process where the serving time at one of its control points is dynamically linked to the global traffic pattern, which is, in turn, dynamically linked to the control point. For this closed-loop system to be effective, the traffic management system must sense and interpret large spatial projections of data originating from multiple sensor suites. The intent of the Wide-Area Surveillance (WAS) Project is to build upon this concept and define the operational specifications and characteristics of a Traffic Flow Wide-Area Surveillance (TFWAS) system in terms of traffic management and control. In doing so, the functional capabilities of a TFWAS will be mapped onto an operational profile that is consistent with the Federal Highway Administration's Intelligent Vehicle Highway System. This document provides the underlying foundation of this work by offering a concept definition for the TFWAS system. It concentrates on answering the question: "What is the system?" In doing so, the report develops a hierarchy of specialized definitions.

27860 Propulsion and stabilization system for magnetically levitated vehicles. Coffey, H.T. To Dept. of Energy. 1992. Filed date 28 Jun 1992. U.S. Patent Application 7-920,736. 15p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. Order Number DE94016131. Source: OSTI; NTIS; GPO Dep.

A propulsion and stabilization system for an inductive repulsion type magnetically levitated vehicle which is propelled and stabilized by a system which includes propulsion windings mounted above and parallel to vehicle-borne suspension magnets. A linear synchronous motor is part of the vehicle guideway and is mounted above and parallel to superconducting magnets attached to the magnetically levitated vehicle.

27861 Magnetic levitation configuration incorporating levitation, guidance and linear synchronous motor. Coffey, H.T. To Dept. of Energy. 1992. Filed date 28 Jul 1992. U.S. Patent Application 7-920,737. 16p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. Order Number DE94016130. Source: OSTI; NTIS; GPO Dep.

A propulsion and suspension system for an inductive repulsion type magnetically levitated vehicle which is propelled and suspended by a system which includes propulsion windings which form a linear synchronous motor and conductive guideways, adjacent to the propulsion windings, where both combine to partially encircling the vehicle-borne superconducting magnets. A three phase power source is used with the linear synchronous motor to produce a traveling magnetic wave which in conjunction with the magnets propel the vehicle. The conductive guideway combines with the superconducting magnets to provide for vehicle leviation.

3203 Industrial and Agricultural Processes

Refer also to citation(s) 27211, 27324, 27329, 27365, 27394, 27931, 27962, 27991, 27992, 28040, 28072, 28087, 28359, 28484, 28946

27862 (EGG-RAAM–11278) **Recycled Materials Affirmative Procurement Tracking System (RMAPTS): Software user's manual.** EG and G Idaho, Inc., Idaho Falls, ID (United States). [1994]. 49p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE94015272. Source: OSTI; NTIS; GPO Dep.

RMAPTS is designed to interact with other computer systems. This system can upload or download data from other RMAPTS systems. RMAPTS also complies with Federal Acquisition Regulations (FARs). Section 6002 of the Resource Conservation of Recovery Act (RCRA), Title 40 Part 247-25 of the Code of Federal Regulations, and Executive Order 12780 present mandates and guidelines to the Department of Energy (DOE) and its contractors for the procurement of products containing recycled materials. These regulations promote cost-effective waste reduction and recovery of reusable materials from Federally generated waste;

promote environmentally sound and economically efficient waste reduction and recycling of the nation's resources; and stimulate private sector markets through preferential procurement of designated items. On August 4, 1992, the Deputy Secretary of the Department of Energy requested DOE to show its commitment to Executive Order 12780, Federal Agency Recycling and Procurement Policy. This software was developed in response to this request. RMAPTS will allow users to track and report specific data concerning the procurement of products that contain recycled material and the quantity of recycled material contained in each product. This system provides greater detail, improved accuracy, and less time spent on year-end reporting. Users can quickly check the year-to-date status of recycled material purchases and recycled material contents of products at any time.

27863 (KCP–613-5303) **Process waste assessment: Color print processing (RA-4).** Catlett, P. Allied-Signal Aerospace Co., Kansas City, MO (United States). Kansas City Div. May 1994. 24p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00613. Order Number DE94015863. Source: OSTI; NTIS; GPO Dep.

The Kodak RA-4 process is used to develop prints and overhead transparencies from photographic negatives. The assessment was based on usage, effluent discharge, and final disposition of waste generated by the process. Two options explored were bleach-fix regeneration and the conversion to a digital image processing system. The RA-4 process is process is environmentally sound and generates a relatively small amount of waste. The bleach-fix option would provide only a small effluent reduction. The digital imaging conversion option, if fully implemented, could greatly reduce waste generated in the photo lab.

27864 (PNL-SA–24365) **Fluid dynamic effects on precision cleaning with supercritical fluids.** Phelps, M.R.; Hogan, M.O.; Silva, L.J. Pacific Northwest Lab., Richland, WA (United States). Jun 1994. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. (CONF-9406181–3: Joint Army, Navy, NASA, Air Force environmentally benign cleaning and degreasing technical workshop, Indian Head, MD (United States), 14-15 Jun 1994). Order Number DE94015001. Source: OSTI; NTIS; GPO Dep.

Pacific Northwest Laboratory staff have assembled a small supercritical fluids parts cleaning test stand to characterize how system dynamics affect the efficacy of precision cleaning with supercritical carbon dioxide. A soiled stainless steel coupon, loaded into a "Berty" autoclave, was used to investigate how changes in system turbulence and solvent temperature influenced the removal of test dopants. A pulsed laser beam through a fiber optic was used to investigate real-time contaminant removal. Test data show that cleaning efficiency is a function of system agitation, solvent density, and temperature. These data also show that high levels of cleaning efficiency can generally be achieved with high levels of system agitation at relatively low solvent densities and temperatures. Agitation levels, temperatures, and densities needed for optimal cleaning are largely contaminant dependent. Using proper system conditions, the levels of cleanliness achieved with supercritical carbon dioxide compare favorably with conventional precision cleaning methods. Additional research is currently being conducted to generalize the relationship between cleaning performance and parameters such as contaminant solubilities, mass transfer rates, and solvent agitation. These correlations can be used to optimize cleaning performance, system design, and time and energy consumption for particular parts cleaning applications.

27865 (SAND–94-1383C) **Learning one-dimensional geometric patterns under one-sided random misclassification noise.** Goldberg, P.W. (Sandia National Laboratories, Albuquerque, NM (United States)); Goldman, S.A. Sandia National Labs., Albuquerque, NM (United States). [1994]. 11p. Sponsored by USDOE, Washington, DC (United States);National Science Foundation, Washington, DC (United States). DOE Contract AC04-94AL85000. Grant CCR-9110108; Grant CCR-9357707. (CONF-940794–1: Conference on computational learning theory, New Brunswick, NJ (United States), 10-15 Jul 1994). Order Number DE94014659. Source: OSTI; NTIS; GPO Dep.

Developing the ability to recognize a landmark from a visual image of a robot's current location is a fundamental problem in robotics. The authors consider the problem of PAC-learning the concept class of geometric patterns where the target geometric pattern is a configuration of k points in the real line. Each instance is a configuration of n points on the real line, where it is labeled according to whether or not it visually resembles the target pattern. They relate the concept class of geometric patterns to the landmark recognition problem and then present a polynomial-time algorithm that PAC-learns the class of one-dimensional geometric patterns when the negative examples are corrupted by a large amount of random misclassification noise.

27866 (UCRL-JC–116773) **The future of diode pumped solid state lasers and their applicability to the automotive industry.** Solarz, R. (and others); Beach, R.; Hackel, L. Lawrence Livermore National Lab., CA (United States). Mar 1994. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-9403138–1: Automotive laser applications workshop, Dearborn, MI (United States), 7-8 Mar 1994). Order Number DE94014736. Source: OSTI; NTIS; GPO Dep.

The largest commercial application of high power lasers is for cutting and welding. Their ability to increase productivity by introducing processing flexibility and integrated automation into the fabrication process is well demonstrated. This paper addresses the potential importance of recent developments in laser technology to further impact their use within the automotive industry. The laser technology we will concentrate upon is diode laser technology and diode-pumped solid-state laser technology. We will review present device performance and cost and make projections for the future in these areas. Semiconductor laser arrays have matured dramatically over the last several years. They are lasers of unparalleled efficiency (greater than 50%), reliability (greater than 10,000 hours of continuous operation), and offer the potential of dramatic cost reductions (less than a dollar per watt). They can be used directly in many applications or can be used to pump solid-state lasers. When used as solid-state laser pump arrays, they simultaneously improve overall laser efficiency, reduce size, and improve reliability.

3206 Municipalities and Community Systems

Refer also to citation(s) 27578, 27579, 27861, 28466

27867 (DOE/RL–94-28) **State Waste Discharge Permit application: 400 Area Septic System.** USDOE Richland Operations Office, WA (United States). Jun 1994. 96p. Sponsored by USDOE, Washington, DC (United States). Order Number DE94015334. Source: OSTI; NTIS; GPO Dep.

As part of the Hanford Federal Facility Agreement and Consent Order negotiations, the US Department of Energy, Richland Operations Office, the US Environmental Protection Agency, and the Washington State Department of Ecology agreed that liquid effluent discharges to the ground on the Hanford Site which affects groundwater or has the potential to affect groundwater would be subject to permitting under the structure of Chapter 173-216 (or 173-218 where applicable) of the Washington Administrative Code, the State Waste Discharge Permit Program. This document constitutes the State Waste Discharge Permit application for the 400 Area Septic System. The influent to the system is domestic waste water. Although the 400 Area Septic System is not a Public Owned Treatment Works, the Public Owned Treatment Works application is more applicable than the application for industrial waste water. Therefore, the State Waste Discharge Permit application for Public Owned Treatment Works Discharges to Land was used.

27868 (DOE/SR/15191–8) **Natural resources management activities and biodiversity maintenance: Progress report, July 1, 1993–June 30, 1994.** Caudell, M.B. South Carolina Wildlife and Marine Resources Dept., Columbia, SC (United States). May 1994. 3p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG09-87SR15191. Order Number DE94017153. Source: OSTI; NTIS; GPO Dep.

This progress report briefly outlines activities at the Crackerneck Wildlife Management Area. Thirty-nine days were spent administering hunts with 1524 people participating. Biological data was

collected on 89 deer, 6 turkeys, 8 feral hogs, 40 ducks of two species, 24 bobwhite, 3 rabbits, 2 gray squirrels, and 313 fish of 8 species. Public relations, maintenance and hunt preparation activities are summarized as well.

27869 (FVU–94-2) **Relining district heating piping - modification of the test rigs.** Bjurstroem, H. Fjaerrvaermeutveckling FVU AB, Nykoeping (Sweden). Feb 1994. 13p. (In Swedish). Project NUTEK-654-028. Order Number DE94783393. Source: OSTI; NTIS.

Relining pipes could be a technique to renew piping with a minimum of excavation work. Recently developed epoxy-based liners have been subjected to preliminary tests without showing any degradation. Within this project, test rigs have been redesigned and modified for use in a more comprehensive test of the liners. The work done here was necessary for the continued investigation of the applicability of the liners to district heating conditions

27870 (FVU–94-4) **The research program on distribution of district heat 1992/93 at Fjaerrvaermeutveckling FVU AB.** Bjurstroem, H. Fjaerrvaermeutveckling FVU AB, Nykoeping (Sweden). Feb 1994. 14p. (In Swedish). Project NUTEK-654-028. Order Number DE94783394. Source: OSTI; NTIS.

Applied research and development program undertaken at Fjaerrvaermeutveckling FVU AB with financial support from NUTEK aims at methods for determining the state of district heating piping and for its renovation. The three topics addressed in this program during 1992 are: -relining district heating piping, -leak localization, -methods to determine the state of insulation. The work in each subproject has been reported in detail in separate reports. In the subproject relining, test rigs for the investigation in the laboratory of lining material have been completed. Testing of the liners is presently under way in a continuation of the program reported here. In the subproject leak localization, a correlator LOKAL developed especially for the conditions specific to district heating networks has been assessed. The subproject treating insulation consists of two parts. In the first part, methods to determine the thermal conductivity of insulation have been investigated and a commercially available instrument has been assessed. This instrument is the basis of a cooperative project on quality control on reception and on the aging of PUR-foam insulation. In the second part an instrument for determining the water content of insulation has been developed. 4 refs

27871 (FVU-FU–93-9) **Investigation of simplified methods for the determination of thermal conductivity in pipe insulation.** Torstensson, H. Fjaerrvaermeutveckling FVU AB, Nykoeping (Sweden). Apr 1993. 34p. (In Swedish). Order Number DE94783392. Source: OSTI; NTIS.

This report describes the investigation of one dynamic and one steady state method for the determination of the thermal conductivity in insulation materials. To study the dynamic method, a laboratory device was developed and to test the steady state method, a battery operated hand instrument was used. The investigation of the two methods showed a distinct advantage to the steady state method performed with a compact and handy instrument operating with only a thin measuring probe. The thermal conductivity is displayed directly after the completion of the measuring process and the measurements show good accuracy of reproduction. The instrument is available on the market. For the present, there is no justification for further development of the dynamic method. Even if the apparatus can be improved, the disadvantage of establishing the density and the heat capacity of the material remains. In addition, the determination of the distances between the heat source and the measuring points have to be very precise. Hence, the choice should be to continue the evaluation of the hand instrument. The next step should be to perform measurements in material where the thermal conductivity is known, to determine the absolute accuracy of the instrument. 6 refs, 11 figs, 2 tabs

27872 (NREL/TP–430-6078) **Municipal solid waste management: A bibliography of US Department of Energy contractor reports through 1993.** Shepherd, P. National Renewable Energy Lab., Golden, CO (United States). Jul 1994. 181p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC36-83CH10093. Order Number DE94011805. Source: OSTI; NTIS; GPO Dep.

US Department of Energy contractors continue to conduct research targeting the productive and responsible use of the more than 536,000 tons of municipal solid waste (MSW) that is generated each day in the United States. It is becoming more and more prudent to improve current methods of MSW management and to continue to search for additional cost-effective, energy-efficient means to manage our MSW resource. This bibliography is an updated version of Municipal Waste to Energy: An Annotated Bibliography of US Department of Energy Contractor Reports, by Caroline Brooks, published in 1987. Like its predecessor, this bibliography provides information about technical reports on energy from municipal waste that were prepared under grants or contracts from the US Department of Energy. The reports listed focus on energy from municipal waste technologies and energy conservation in wastewater treatment. The bibliography contains three indexes – an author index, a subject index, and a title index. The reports are listed alphabetically in the subject areas and may appear under more than one subject. All of the reports cited in the original MSW bibliography are also included in this update. The number of copies of each report originally published varied according to anticipated public demand. However, all reports are available in either microfiche or hard copy form and may be ordered from the National Technical Information Service (NTIS), US Department of Commerce, Springfield, VA 22161. Explicit information on ordering reports is included in Appendix A.

27873 (ORNL/CON–375) **Low-income DSM Programs: Methodological approach to determining the cost-effectiveness of coordinated partnerships.** Brown, M.A.; Hill, L.J. Oak Ridge National Lab., TN (United States). May 1994. 140p. Sponsored by USDOE, Washington, DC (United States);New York State Government, Albany, NY (United States);North Carolina State Government, Raleigh, NC (United States);New York State Energy Research and Development Authority, Albany, NY (United States). DOE Contract AC05-84OR21400. Order Number DE94014956. Source: OSTI; NTIS; GPO Dep.

As governments at all levels become increasingly budget-conscious, expenditures on low-income, demand-side management (DSM) programs are being evaluated more on the basis of efficiency at the expense of equity considerations. Budgetary pressures have also caused government agencies to emphasize resource leveraging and coordination with electric and gas utilities as a means of sharing the expenses of low-income programs. The increased involvement of electric and gas utilities in coordinated low-income DSM programs, in turn, has resulted in greater emphasis on estimating program cost-effectiveness. The objective of this study is to develop a methodological approach to estimate the cost- effectiveness of coordinated low-income DSM programs, given the special features that distinguish these programs from other utility-operated DSM programs. The general approach used in this study was to (1) select six coordinated low-income DSM programs from among those currently operating across the United States, (2) examine the main features of these programs, and (3) determine the conceptual and pragmatic problems associated with estimating their cost-effectiveness. Three types of coordination between government and utility cosponsors were identified. At one extreme, local agencies operate "parallel" programs, each of which is fully funded by a single sponsor (e.g., one funded by the U.S. Department of Energy and the other by a utility). At the other extreme are highly "coupled" programs that capitalize on the unique capabilities and resources offered by each cosponsor. In these programs, agencies employ a combination of utility and government funds to deliver weatherization services as part of an integrated effort. In between are "supplemental" programs that utilize resources to supplement the agency's government-funded weatherization, with no changes to the operation of that program.

27874 (PNL–9976) **Lessons learned from new construction utility demand side management programs and their implications for implementing building energy codes.** Wise, B.K.; Hughes, K.R.; Danko, S.L.; Gilbride, T.L. Pacific Northwest Lab., Richland, WA (United States). Jul 1994. 65p. Sponsored by

USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE94015882. Source: OSTI; NTIS; GPO Dep.

This report was prepared for the US Department of Energy (DOE) Office of Codes and Standards by the Pacific Northwest Laboratory (PNL) through its Building Energy Standards Program (BESP). The purpose of this task was to identify demand-side management (DSM) strategies for new construction that utilities have adopted or developed to promote energy-efficient design and construction. PNL conducted a survey of utilities and used the information gathered to extrapolate lessons learned and to identify evolving trends in utility new-construction DSM programs. The ultimate goal of the task is to identify opportunities where states might work collaboratively with utilities to promote the adoption, implementation, and enforcement of energy-efficient building energy codes.

27875 (PNL-SA–24197) **Assessment and implementation of a district heating system upgrade for the city of Plzen, Czech Republic: Status report.** Secrest, T.J. (Pacific Northwest Lab., Richland, WA (United States)); Marousek, J. Pacific Northwest Lab., Richland, WA (United States). Jun 1994. 13p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. (CONF-940614–1: 85. annual conference of the International District Heating and Cooling Association and trade show, Seattle, WA (United States), 18-22 Jun 1994). Order Number DE94014996. Source: OSTI; NTIS; GPO Dep.

The City of Plzen, Czech Republic, is considering options to upgrade its district heating system for compliance with emissions regulations and replacement of some existing heat generation units. This assessment examined two coal-fired and two-gas fired heat generation configurations coupled with buildings sector energy efficiency for meeting load growth from the current level of 370MWt to 420 and 367MWt for high and low growth scenarios, respectively. The supply and efficiency options were integrated and characterized by capital requirement, levelized energy cost, typical residential energy bill, and emissions. Life extension to the existing facilities required the least capital investment and provided the lowest levelized energy cost; efficiency increased the per unit price of energy and reduced the typical energy bill; connection of a satellite system provided for a lower weighted average energy cost of energy over life extension to the satellite boiler serving the system; and the gas-fired configurations provided for the greatest reduction in emissions.

33 ADVANCED PROPULSION SYSTEMS

3301 Internal Combustion Engines

27876 (DOE/NASA–0336-4) **ATTAP: Advanced Turbine Technology Applications Project: Annual report, 1991.** General Motors Corp., Indianapolis, IN (United States). Allison Gas Turbine Div. Dec 1992. 89p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC21-93MC29257. (NASA/CR–195367; EDR–16624). Order Number DE94016854. Source: OSTI; NTIS; GPO Dep.

Purpose of ATTAP is to bring the automotive gas turbine engine to a technology state at which industry can make commercialization decisions. Activities during the past year included test-bed engine design and development, ceramic component design, materials and component characterization, ceramic component process development and fabrication, ceramic component rig testing, and test-bed engine fabrication and testing.

27877 (LA-SUB–94-89) **Laser initiated piston actuator X51-8284-1.** Spomer, E. (Pacific Scientific Co., Avondale-Goodyear, AZ (United States). Energy Dynamics Div.). Los Alamos National Lab., NM (United States); Pacific Scientific Co., Avondale-Goodyear, AZ (United States). Energy Dynamics Div. 27 Apr 1993. 90p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. Order Number DE94015424. Source: OSTI; NTIS; GPO Dep.

This contract is a follow on effort in the development of a laser initiated piston actuator. During the previous contract a miniature piston actuator was developed which had two system related problems. First, during operation of the actuator, combustion gases would escape past the piston shank, overheating the surrounding materials. Secondly, the function of the device seemed to be overly brisant. The purpose of this contract was to improve the performance of the laser initiated piston actuator by developing a means of sealing the device, and to reduce the velocity of the piston. Three sealing concepts were tested; a silicone pad placed on the powder side of the piston, a stainless steel cup placed on the powder side of the piston, and copper plating on the shank of the piston. Piston velocity was to be reduced by changing the powder charge to BCTK or reducing the amount of $Ti/KClO_4$.

27878 (NREL/TP–425-6161) **Effects of piston surface treatments on performance and emissions of a methanol-fueled, direct injection, stratified charge engine.** West, B. (Oak Ridge National Lab., TN (United States)); Green, J.B. National Renewable Energy Lab., Golden, CO (United States). Jul 1994. 14p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC36-83CH10093. Order Number DE94011851. Source: OSTI; NTIS; GPO Dep.

The purpose of this study was to investigate the effects of thermal barrier coatings and/or surface treatments on the performance and emissions of a methanol-fueled, direct-injection, stratified-charge (DISC) engine. A Ricardo Hydra Mark III engine was used for this work and in previous experiments at Oak Ridge National Laboratory (ORNL). The primary focus of the study was to examine the effects of various piston insert surface treatments on hydrocarbon (HC) and oxides of nitrogen (NO_x) emissions. Previous studies have shown that engines of this class have a tendency to perform poorly at low loads and have high unburned fuel emissions. A blank aluminum piston was modified to employ removable piston bowl inserts. Four different inserts were tested in the experiment: aluminum, stainless steel with a 1.27-mm (0.050-in.) air gap (to act as a thermal barrier), and two stainless steel/air-gap inserts with coatings. Two stainless steel inserts were dimensionally modified to account for the coating thickness (1.27-mm) and coated identically with partially stabilized zirconia (PSZ). One of the coated inserts then had an additional seal-coat applied. The coated inserts were otherwise identical to the stainless steel/air-gap insert (i.e., they employed the same 1.27-mm air gap). Thermal barrier coatings were employed in an attempt to increase combustion chamber surface temperatures, thereby reducing wall quenching and promoting more complete combustion of the fuel in the quench zone. The seal-coat was applied to the zirconia to reduce the surface porosity; previous research suggested that despite the possibly higher surface temperatures obtainable with a ceramic coating, the high surface area of a plasma-sprayed coating may actually allow fuel to adhere to the surface and increase the unburned fuel emissions and fuel consumption.

27879 **Jet plume injection and combustion system for internal combustion engines.** Oppenheim, A.K.; Maxson, J.A.; Hensinger, D.M. To Dept. of Energy. 1992. Filed date 7 Jul 1992. U.S. Patent Application 7-909,890. 39p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00098. Order Number DE94016141. Source: OSTI; NTIS; GPO Dep.

This invention is comprised of an improved combustion system for an internal combustion engine is disclosed wherein a rich air/fuel mixture is furnished at high pressure to one or more jet plume generator cavities adjacent to a cylinder and then injected through one or more orifices from the cavities into the head space of the cylinder to form one or more turbulent jet plumes in the head space of the cylinder prior to ignition of the rich air/fuel mixture in the cavity of the jet plume generator. The portion of the rich air/fuel mixture remaining in the cavity of the generator is then ignited to provide a secondary jet, comprising incomplete combustion products which are injected into the cylinder to initiate combustion in the already formed turbulent jet plume. Formation of the turbulent jet plume in the head space of the cylinder prior to ignition has been found to yield a higher maximum combustion pressure in the cylinder, as well as shortening the time period to attain such a maximum pressure.

3303 Electric-Powered Systems

Refer also to citation(s) 27859, 27860

27880 (DOE/ID–10293) **SIMPLEV: A simple electric vehicle simulation program, Version 1.0.** Cole, G.H. EG and G Idaho, Inc., Idaho Falls, ID (United States). Jun 1991. 134p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE94015257. Source: OSTI; NTIS (documentation only); ESTSC (complete software package), P.O. Box 1020, Oak Ridge, TN 37831-1020; GPO Dep.

An electric vehicle simulation code which can be used with any IBM compatible personal computer was written. This general purpose simulation program is useful for performing parametric studies of electric vehicle performance on user input driving cycles. The program is run interactively and guides the user through all of the necessary inputs. Driveline components and the traction battery are described and defined by ASCII files which may be customized by the user. Scaling of these components is also possible. Detailed simulation results are plotted on the PC monitor and may also be printed on a printer attached to the PC. This report serves as a users' manual and documents the mathematical relationships used in the simulation.

27881 (DOE/ID–10421) **Comparison of the Unique Mobility and DOE-developed ac electric drive systems.** Cole, G.H. EG and G Idaho, Inc., Idaho Falls, ID (United States). Jan 1993. 31p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE94015245. Source: OSTI; NTIS; GPO Dep.

A comparison was made between the most recent DOE-developed AC electric vehicle drive systems and that which is independently under development by Unique Mobility of Golden, Colorado. The DOE-developed AC systems compared in this study are the Single-Shaft Electric Propulsion System (ETX-II) developed by Ford Motor Company and the General Electric Company under contract number DE-AC07-85NV10418, the Dual-Shaft Electric Propulsion (DSEP) System developed by Eaton Corporation under contract number DOE-AC08-84NV-10366, and the anticipated results of the Modular Electric Vehicle (MEV) system currently being developed by Ford and General Electric under contract number DE-AC07-90ID13019. The Unique Mobility brushless DC electric vehicle drive system represents their latest electric drive technology and is being developed in cooperation with BMW Technik Gmbh of Germany. Comparisons of specific volume, specific weight, efficiency and expected vehicle performance are made of the different systems based upon measured system performance data where available. One conclusion presented is that the Unique Mobility drive system under development with BMW appears to provide comparable performance to the AC systems studied.

27882 (DOE/ID–10426) **Performance testing of the Ford/GE Second Generation Single-Shaft Electric Propulsion (ETX-II) System.** MacDowall, R.D.; Burke, A.F. EG and G Idaho, Inc., Idaho Falls, ID (United States). Jun 1993. 79p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE94015258. Source: OSTI; NTIS; GPO Dep.

System-level-operational testing of the ETX-II test-bed electric vehicle is described and the results discussed. Because the traction battery is a major factor in the performance of an electric vehicle, previously reported work on the sodium-sulfur battery designed for use with the ETX-II is reviewed in detail. Chassis dynamometer performance of the test-bed vehicle met or exceeded design goals and compared reasonably well with SIMPLEV computer modeling results. Areas are identified wherein further work is needed to establish a firmer basis for comparison of the simulation and the observed results.

27883 (LA-UR–94-2385) **Performance evaluation of polyaniline as an active material for electrochemical capacitors.** Rudge, A.; Davey, J.; Uribe, F.; Landeros, J. Jr.; Gottesfeld, S. Los Alamos National Lab., NM (United States). [1994]. 17p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-940529–19: 185. Electrochemical Society meeting, San Francisco, CA (United States), 22-27 May 1994). Order Number DE94016283. Source: OSTI; NTIS; GPO Dep.

This paper describes experiments which evaluate the performance of polyaniline (PAni) as an active material in electrochemical capacitors. We have performed constant current multicycle tests on prototype symmetric devices where the same conducting polymer serves as the active material on both electrodes. When electropolymerized at high current density in aqueous acid solution, PAni exhibits a micro-morphology consisting of a network of interwoven fibrils with high porosity. Thick PAni layers (>250 μm) of the material can thus be electropolymerized onto a planar metal substrate without affecting the fast dynamics of the charge-discharge process. The aqueous PAni electrochemical capacitors exhibit rather low energy content because of limitations on the maximum applied voltage. However, due to their optimized morphology and the high conductivity of the aqueous acid solution, they exhibit relatively high power density. The PAni capacitor exhibits excellent cycle life (more than 25,000 cycles), provided the requirements on restricted cell voltage are met. This is a key result in the evaluation of conducting polymers as active materials in electrochemical capacitors. Scanning electron microscopy and impedance spectroscopy are used to provide information on this system.

3308 Alternative Fuels

Refer also to citation(s) 27857, 27877

35 ARMS CONTROL

3502 Proliferation

Refer also to citation(s) 27268, 27532, 27533, 27534, 27682, 27743

3503 Verification

Refer also to citation(s) 27535, 28394, 28395, 28396

27884 (LA-UR–94-2581) **String-survey results from the CHECKPRO exercise.** Wright, B.L. Los Alamos National Lab., NM (United States). [1994]. 16p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. Order Number DE94016202. Source: OSTI; NTIS; GPO Dep.

Exercise CHECKPRO was conducted by the Arms Control and Nonproliferation Division at DOE/NVOO to evaluate procedures related to verification of the Threshold Test Ban Treaty. It took place at the Edgar Mine, operated by the Colorado School of Mines, from June 1 through June 19, 1994. One of the procedures being considered was a method for determining the coordinates of installed hydrodynamic sensor cables without the use of conventional surveying equipment. A test of this method was made for a cable installation similar to the one proposed for the Russian PRILIV event. Though the accuracy obtained, about 4 mm, was more than adequate for verification purposes, the man-hour requirements of the method make its use questionable for likely fielding scenarios.

36 MATERIALS

27885 (ORNL/TM–12763) **Advanced Industrial Materials Program: Annual progress report, FY 1993.** Stooksbury, F. (comp.). Oak Ridge National Lab., TN (United States). Jun 1994. 438p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE94015528. Source: OSTI; NTIS; GPO Dep.

Mission of the AIM program is to commercialize new/improved materials and materials processing methods that will improve energy efficiency, productivity, and competitiveness. Program investigators in the DOE national laboratories are working with about 100 companies, including 15 partners in CRDAs. Work is being done on intermetallic alloys, ceramic composites, metal composites, polymers, engineered porous materials, and surface modification. The program supports other efforts in the Office of Industrial Technologies to assist the energy-consuming process industries. The aim of the AIM program is to bring materials from

basic research to industrial application to strengthen the competitive position of US industry and save energy.

3601 Metals and Alloys

Refer also to citation(s) 27276, 27410, 27512, 27641, 27668, 27687, 27688, 27689, 27690, 27691, 27692, 27693, 27694, 27700, 27758, 27993, 28010, 28051, 28267, 28388, 28769, 28775, 28778, 28832, 28848, 28871, 28873, 28970

27886 (ANL/IPNS/CP–83316) **Coherency strains and coarsening in Ni-Al-Si alloys: An experimental study.** Muralidharan, G. (Argonne National Lab., IL (United States)); Epperson, J.E.; Petri, M.; Chen, H. Argonne National Lab., IL (United States). Intense Pulsed Neutron Source (IPNS) Program. [1994]. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-940704–1: International conference on solid-to-solid phase transformations in organic materials, Pittsburgh, PA (United States), 17-22 Jul 1994). Order Number DE94015020. Source: OSTI; NTIS; GPO Dep.

Coarsening rates have been measured in a series of alloys in the ternary Ni-Al-Si system using in-situ Small Angle Neutron Scattering, the alloys having a constant Ni content and their Si content varying from 4.0 at. % to 11.0 at. %. Using expressions available in the literature for describing coarsening in multi-component systems, it is shown that it is possible to account for the variation in coarsening rates due to chemical effects. It is observed that the quality of the fit is improved if the composition dependence of the diffusion coefficient is considered in the analysis. Finally, the possible contribution of coherence strains to the measured coarsening rates is discussed.

27887 (BNL–49792) **Practical aspects of corrosion fundamentals.** Isaacs, H.S. Brookhaven National Lab., Upton, NY (United States). [1994]. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH00016. (CONF-940529–18: 185. Electrochemical Society meeting, San Francisco, CA (United States), 22-27 May 1994). Order Number DE94015842. Source: OSTI; NTIS; GPO Dep.

Aspects important in corrosion have been introduced. They are: (a) "Pourbaix Diagrams" which consider thermodynamic stability of metals as a function of electrical potential and water pH; (b) the anodic interfacial reaction rates which depend on potential and accumulation of reaction products; (c) the prediction of polarization curves based on the kinetics and thermodynamics; and (d) localized corrosion models, as this form of corrosion is a major cause of corrosion failures.

27888 (CONF-940731–Absts.) **Second international conference on computer simulation of radiation effects in solids.** de la Rubia, T.D.; Gilmer, G.H. (comps.). Lawrence Livermore National Lab., CA (United States). [1994]. 136p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. From 2. international conference on computer simulation of radiation effects; Santa Barbara, CA (United States); 24-29 Jul 1994. Order Number DE94016368. Source: OSTI; NTIS; INIS; GPO Dep.

A total of 102 abstracts are included, arranged under the following headings: interatomic potentials and theoretical methods, displacement cascades and radiation effects in metals, radiation effects in semiconductors, sputtering and surface processes, cluster-solid interactions, highly charged ions and inelastic effects, and posters (A and B).

27889 (DOE/ER/45308–7) **Novel concepts in weld science: Role of gradients and composite structure: Final report.** Matlock, D.K.; Olson, D.L. Colorado School of Mines, Golden, CO (United States). Center for Welding and Joining Research. Mar 1994. 23p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-87ER45308. (MT-CWR–094-013). Order Number DE94015482. Source: OSTI; NTIS; GPO Dep.

The effects of compositional and microstructural gradients on weld metal and simulated weld metal properties were evaluated in this multi-part study. The results obtained on single phase solid solution systems were used as a basis for a fundamental study of the effects of compositional gradients on crack growth, both at low temperatures, in fatigue and at high temperatures during creep. Methods to physically simulate gradients in weld metals with roll bonded laminate composites were applied to analyses of ferrite-austenite and ferrite-sigma-austenite multiphase systems. Finally, results of the physical simulation analyses were utilized to predict the effects of weld process parameters on weld metal properties.

27890 (DOE/ER/45328–8) **Surface phases, surface defects and the initial stages of oxidation: Progress report, August 15, 1993–August 14, 1994.** Blakely, J. Cornell Univ., Ithaca, NY (United States). Dept. of Materials Science and Engineering. Mar 1994. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-87ER45328. Order Number DE94016947. Source: OSTI; NTIS; GPO Dep.

The 2-D system S + O on Ni(111) has been studied. Results show that S, which initially bonds strongly to Ni, remains concentrated at the interface even after many monolayers of oxide have grown. During this period, studies were carried out on the breakup of Fe oxide layers under S exposure in an Environmental Scanning Electron Microscope. The oxide layers were grown on a (100) surface of 40 Fe –60 Ni alloy. At low temperatures, S from H_2S had no effect on the oxide layer, but at 500 C, the oxide layer broke up. Atomic force microscopic study was also carried out.

27891 (DOE/ER/54160–1-Vol.3, pp. 1935-1941) **Pulse heat treatment of material surface by high-current electron beam.** Engelko, V.I. (D.V. Efremov Scientific Research Institute of Electrophysical Apparatus, St. Petersburg (Russian Federation)); Lazarenko, A.V.; Pechersky, O.P. Maryland Univ., College Park, MD (United States). [1992]. (CONF-920515–Vol.3: 9. international conference on high power particle beams, Washington, DC (United States), 25-29 May 1992). In *Beams 92: Proceedings: Volume 3, Microwaves, Free electron lasers, Advanced accelerators, Applications, and Plasma discharges.* 681p. Order Number DE94014785. Source: OSTI; NTIS; INIS.

Results of the studies of high-current pulsed electron beam effect on a material surface are presented. An electron beam was produced in an accelerator with a multi-point explosion-emission cathode (60-180 kV, 4-40 μsec, 10-60 J/cm^2). Modification of the surface properties was observed at the irradiation energy density, exceeding 22-25 J/cm^2 and the depth of a modified layer in 10-50 μm range. The hardness of a treated surface layer exceeded that of the base by a factor 2-5. The use of HEB treatment to obtain other possible surface modifications is also discussed.

27892 (DOE/ER/54160–1-Vol.3, pp. 1942-1947) **Dissipation of stress wave energy and structural modification of steels radiated by a low-energy high-current electron beam.** Itin, V.I. (Institute of High-Current Electronics, Tomsk (Russian Federation)); Ivanov, Yu.F.; Lykov, S.V.; Mesyats, G.A.; Ozur, G.E.; Proskurovsky, D.I.; Rotshtein, V.P. Maryland Univ., College Park, MD (United States). [1992]. (CONF-920515–Vol.3: 9. international conference on high power particle beams, Washington, DC (United States), 25-29 May 1992). In *Beams 92: Proceedings: Volume 3, Microwaves, Free electron lasers, Advanced accelerators, Applications, and Plasma discharges.* 681p. Order Number DE94014785. Source: OSTI; NTIS; INIS.

The results of investigation of the mechanism of hardening of previously hardened carbon steel (0.45 - 1.2 % C) by microsecond low-energy high-current electron beam are presented. It is shown that maximum hardening is reached beyond the thermal action zone and is caused by effect bipolar stress wave on martensite. Intense deformation processes initiated in region of penetration of this wave leads to the formation of strongly fragmented structure with high level of defectivity and anomalously high values of microhardness.

27893 (DOE/ER/54160–1-Vol.3, pp. 1948-1953) **Action of a nanosecond megavolt high-current electron beam on metals and alloys.** Goncharenko, I.M. (Institute of High-Current Electronics, Tomsk (Russian Federation)); Efremov, A.M.; Ivanov, Yu.F.; Itin, V.I.; Koval'chuk, B.M.; Lykov, S.V.; Markov, A.B.; Rotshtein, V.P.; Tukhfatullin, A.A. Maryland Univ., College Park, MD (United States). [1992]. (CONF-920515–Vol.3: 9. international conference on high power particle beams, Washington, DC (United States), 25-29 May 1992). In *Beams 92: Proceedings: Volume 3,*

Microwaves, Free electron lasers, Advanced accelerators, Applications, and Plasma discharges. 681p. Order Number DE94014785. Source: OSTI; NTIS; INIS.

Using the X-ray structural and the transmission electron microscopy analyses specific features of the phase and structure transformations in armco-iron and steel 45 affected by a high-current electron beam of $\sim 10^{11}$ W/cm^2 power density have been studied. It was revealed that hardening of steel with the martensite structure is of a through quasi-periodic character is caused by the action of a shock wave. The action of a shock wave results in formation of a thin (0.1-0.2 μm) layer on rear side of samples. The layer is composed of subgrains of α-ferrite of a regular hexagonal shape with thin layers of graphite on their boundaries.

27894 (DOE/ER/54160–1-Vol.3, pp. 1960-1965) **Enhancement of metal properties by irradiation with intense, high-energy electron beams.** Struve, K.W. (Mission Research Corp., Albuquerque, NM (United States)); Smith, A.C.; Neau, E.L. Maryland Univ., College Park, MD (United States). [1992]. (CONF-920515–Vol.3: 9. international conference on high power particle beams, Washington, DC (United States), 25-29 May 1992). In *Beams 92: Proceedings: Volume 3, Microwaves, Free electron lasers, Advanced accelerators, Applications, and Plasma discharges.* 681p. Order Number DE94014785. Source: OSTI; NTIS; INIS.

There has been considerable interest in low energy (30-120 keV) electron beam surface treatment for both hardening and corrosion protection of steels and other alloys. Techniques involve either melting the surface or raising the temperature to near melt and relying on self-quenching to rapidly cool the material below the critical transition temperature. With iron, for example, both carbon and carbides are dissolved in both the austenite (above 910°C) and liquid phases. The rapid cooling to below 710°C prevents growth of large ferric carbide (Fe_3C) or cementite crystals and thus produces a much harder surface. At sufficiently high cooling rates martensite or even amorphous compositions can be produced. With previously used low-energy electron beams, only the top to 100 μm of the material is directly heated by the electrons, although the heat affected zone may extend much further into the material. Recent accelerators have been developed in the high-current beam propagation program which have both high current density (>10 kA/cm^2), higher energy (up to 50 MeV), and high average beam power (150 kW). The advantage of using a high-energy machine is that the electron range is much greater. This leads to modifying bulk properties of the material and not just changing surface properties. For example, the range of 10 MeV electrons is nearly 1 cm in iron. The question that remains is whether it is possible to self-quench sufficiently fast when the material is heated to greater depths. The authors propose theory and experiments to study these effects. Theory will involve use of available PIC codes, such as ISIS, for electron deposition, and a radiation transport code, such as CYLTRAN, for radiation transport and deposition. These will provide input to thermal transport codes for determination of heat flow rates. Experiments will consist of irradiating samples with high power, high-energy beams and measuring the resulting materials changes.

27895 (FRCEA-TH–394) **Preparation, structures and magnetic properties of Dy/Zr and Ho/Zr two-layers and multi-layers.** Luche, M.C. CEA Centre d'Etudes de Grenoble, 38 (France). Dept. de Recherche Fondamentale sur la Matiere Condensee; Grenoble-1 Univ., 38 (France). 26 Oct 1993. 168p. (In French). Order Number DE94631703. Source: OSTI; NTIS (US Sales Only); INIS.

The first part of the report is devoted to the description of the ultra-vacuum evaporation equipment, to the sample preparation conditions and to the characterization of the two-layers and multilayers through reflection and glancing incidence X diffraction and transmission electron microscopy. In the second part, the magnetic properties of the samples are studied and relations between properties and structures are examined. 37 fig., 35 ref.

27896 (FRNC-TH–3735) **Physico-chemical behaviour of a metal/polymer contact subject to a low amplitude friction in a chlorinated medium. Effect of ionitriding and ion implantation surface treatment.** Rabbe, L.M. Ecole Nationale Superieure des Mines, 42 - Saint-Etienne (France); Institut National Polytechnique, 38 - Grenoble (France). Oct 1993. 181p. (In French). Order Number DE94631947. Source: OSTI; NTIS (US Sales Only); INIS.

The fretting-corrosion behaviour of two tribological couples (TA6V/PMMA and 316L/PMMA) had been studied in order to better understand the degradation mechanisms observed on pivot prosthesis sealed in bones. Pressure appears to have a major role; at high contact pressure, the PMMA wear is the main degradation mechanism with PMMA debris acting as a metal surface protecting agent; at low contact pressure, both material deterioration is involved, and titanium has a corrosion-dominated degradation. An optimal resistance to fretting is achieved when TA6V is coated with Ti N (ion implantation) and Ti N, Ti_2 N (ionitriding). When nitriding, processing temperature appears as a critical factor to ensure thickness and homogeneity of the nitride coatings. 181 p., 106 figs., 110 refs.

27897 (HW–72901) **Preliminary report on the tensile properties of plutonium.** Gardner, H.R. Battelle, Columbus, OH (United States). 8 Mar 1962. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE94015966. Source: OSTI; NTIS; GPO Dep.

Preliminary data have been obtained on the effect of temperature on the tensile properties of a Pu-0.9 w/o Ga delta stabilized alloy. Contoured castings for tensile specimen fabrication were obtained by pouring in vacuo from 900 °C into a MgO coated graphite mold heated to 475-500 °C.

27898 (INIS-mf–14277) **Superconductivity and vortex properties in various multilayers.** Koorevaar, P. Rijksuniversiteit Leiden (Netherlands). 16 Feb 1994. 127p. Order Number DE94789656. Source: OSTI; NTIS; INIS.

In this thesis three qualitatively different type of superconducting multilayers are studied. We discuss the vortex lattice structure in Nb/NbZr multilayers, a system where both type of constituting layers are superconducting. At certain temperatures and for parallel fields close to $H_{c2parallel}$, the Nb/NbZr system has a strongly modulated order parameter, and in this aspect resembles the high-Tc materials. By lowering the field the modulation decreases, having important consequences for the vortex lattice structure. By studying the transport critical currents we show that in the case of strong modulation the vortex lattice has a kinked structure, but at weaker modulations the vortices are straight, and the change in modulation actually results in a vortex lattice transition. Our study confirms the picture of the existence of kinked vortex lattices, but it is rather surprising that these kinked structures can exist in a system which in itself is not at all that anisotropic. It indicates the relevance of other parameters governing the vortex lattice structure. (orig.)

27899 (JAERI-M–94-022) **Creep properties of 20% cold worked hastelloy XR.** Kurata, Yuji (Japan Atomic Energy Research Inst., Tokai, Ibaraki (Japan). Tokai Research Establishment); Nakajima, Hajime. Japan Atomic Energy Research Inst., Tokyo (Japan). Feb 1994. 35p. (In Japanese). Order Number DE94785198. Source: OSTI; NTIS; INIS.

Creep properties of Hastelloy XR, in 20% cold worked or solution treated condition, were studied at 800, 900 and 1000degC. The results obtained are as follows: (1) At 800degC, creep rupture time of 20% cold worked Hastelloy XR is longer than that of solution treated one. However, the effect disappears above 900degC. At 1000degC, it becomes shorter than that of solution treated Hastelloy XR. (2) Rupture elongation and reduction of area of 20% cold worked Hastelloy XR are smaller than those of solution treated one. While these values of 20% cold worked Hastelloy XR are lowest at 900degC, they recover considerably at 1000degC. (3) Nonclassical creep curves which have the region with low creep rate at an early stage of creep were observed at high temperatures for Hastelloy XR, in 20% cold worked or solution treated condition. (4) Minimum creep rate, ϵ_m, of 20% cold worked Hastelloy XR is decreased by as much at a factor of 20 to 50 at 800 and 900degC. On the other hand, ϵ_m of 20% cold worked Hastelloy XR is increased by as much as a factor of 2 at 1000degC. (5) Although 20% cold work enhances creep resistance of Hastelloy XR at 800 and 900degC, the effect becomes detrimental at 1000degC where dynamic recrystallization occurs during creep. (author).

27900 (KAPL–4763) **Stress corrosion crack tip microstructure in nickel-based alloys.** Shei, S.A.; Yang, W.J. Knolls Atomic Power Lab., Schenectady, NY (United States). Apr 1994. 28p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC12-76SN00052. (CONF-940222–17: Corrosion 94: National Association of Corrosion Engineers (NACE) international annual conference, Baltimore, MD (United States), 28 Feb - 4 mar 1994). Order Number DE94015362. Source: OSTI; NTIS; INIS; GPO Dep.

Stress corrosion cracking behavior of several nickel-base alloys in high temperature caustic environments has been evaluated. The crack tip and fracture surfaces were examined using Auger/ESCA and Analytical Electron Microscopy (AEM) to determine the near crack tip microstructure and microchemistry. Results showed formation of chromium-rich oxides at or near the crack tip and nickel-rich de-alloying layers away from the crack tip. The stress corrosion resistance of different nickel-base alloys in caustic may be explained by the preferential oxidation and dissolution of different alloying elements at the crack tip. Alloy 600 (UNS N06600) shows good general corrosion and intergranular attack resistance in caustic because of its high nickel content. Thermally treated Alloy 690 (UNS N06690) and Alloy 600 provide good stress corrosion cracking resistance because of high chromium contents along grain boundaries. Alloy 625 (UNS N06625) does not show as good stress corrosion cracking resistance as Alloy 690 or Alloy 600 because of its high molybdenum content.

27901 (KAPL–4766) **Properties of semiconducting Ru_2Ge_3.** Fleurial, Jean-Pierre (California Inst. of Tech., Pasadena, CA (United States). Guggenheim Jet Propulsion Center); Borshchevsky, A. Knolls Atomic Power Lab., Schenectady, NY (United States). Sep 1993. 14p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC12-76SN00052. (CONF-9311224–1: 12. international conference on thermoelectrics, Yokohama (Japan), 9-11 Nov 1993). Order Number DE94015361. Source: OSTI; NTIS; GPO Dep.

Transport properties of large single crystalline samples of Ru_2Ge_3 grown from the melt have been investigated in a 25–1000 C temperature range. A diffusionless transition between 500 and 550 C from a high temperature tetragonal structure to a low temperature orthorhombic structure was clearly observed. Results showed that both the low temperature orthorhombic and the high temperature structural tetragonal phase are semiconductors. Some anisotropy of the transport coefficients was determined by measuring the samples in orientations parallel and perpendicular to the preferential direction of crystal growth. Large Seebeck coefficient (up to 400 μVK^{-1}) and low thermal conductivity (as low as 20 $\times$ 10^{-3} $Wcm^{-1}K^{-1}$) were achieved for the low temperature orthorhombic phase. Difficulties in preparing heavily doped samples and low Hall mobilities have limited values for the maximum figure of merit to 0.5 $\times$ 10^{-3} K^{-1}at 500 C.

27902 (KAPL–4782) **Analysis of welding-induced residual stresses with the ADINA system.** Wilkening, W.W,; Snow, J.L. Knolls Atomic Power Lab., Schenectady, NY (United States). Dec 1993. 20p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC12-76SN00052. (CONF-9306354–1: 9. nonlinear finite element analysis and ADINA conference, Boston, MA (United States), 23-25 Jun 1993). Order Number DE94015359. Source: OSTI; NTIS; GPO Dep.

Welding-induced residual stresses analysis procedure (WIRSAP), based on ADINA system of nonlinear finite element software, is described and results of several WIRSAP analyses are discussed. Several 2D axisymmetric WIRSAP analyses were performed for pipe girth welds and for several multi-pass girth-like welds attaching small nozzles to large, thick-walled pressure vessels. The analytical methodology follows closely Rybicki et al, enhanced by several specialized modeling techniques available in ADINA. The element birth option is used to simulate the addition of weld metal, and the mixed pressure/displacement element formulation is used, in conjunction with temperature-dependent bi-linear plasticity material model. Some of the welds analyzed involve backing rings, which were subsequently 'machined off' via use of the element death option. The auto-time-stepping algorithm and matrix update iteration scheme are used in structural solutions. WIRSAP involves, a pass-by-pass analysis of uncoupled thermal and structural problems, but some analyses have been performed with an "enveloping" technique for grouping several weld passes together. The analyses are all 2D, but most are large problems and pose challenge to software and hardware. Operations are performed on a network of Silicon Graphics workstations, and ADINA and ADINA-T are executed on a 64 MW, eight-processor CRAY YIMP. Nominally 50 solution steps are utilized for each weld pass and weld joints involving as many as 31 individual weld passes analyzed on a pass-by-pass basis. Results from several WIRSAP analyses are discussed, and potential use of WIRSAP in a hypothetic attachment weld design optimization study is illustrated.

27903 (KFK–5309) **Corrosion studies on selected metallic materials for application in nuclear waste disposal containers.** Smailos, E. (Empresa Nacional de Residuos, Radiactivos, SA (ENRESA), Madrid (Spain)); Fiehn, B.; Gago, J.A.; Azkarate, I. Kernforschungszentrum Karlsruhe GmbH (Germany). Inst. fuer Nukleare Entsorgungstechnik. Mar 1994. 45p. Sponsored by Commission of the European Communities, Brussels (Belgium). Contract CEC F12W-CT90-0030. Order Number DE94789624. Source: OSTI; NTIS (US Sales Only); INIS.

In previous corrosion studies, carbon steels and the alloy Ti 99.8-Pd were identified as promising materials for heat-generating nuclear waste containers acting as a radionuclide barrier in a rock-salt repository. To characterize the long-term corrosion behaviour of these materials in more detail, a research programme including laboratory-scale and in-situ corrosion studies has been undertaken jointly by KfK and ENRESA/INASMET. In the period under review, gamma irradiation corrosion studies of up to about 6 months at 10 Gy/h and stress corrosion cracking studies at slow strain rates (10^{-4}-10^{-7} s^{-1}) were performed on three preselected carbon steels in disposal relevant brines (NaCl-rich, $MgCl_2$-rich) at 90 C and 150 C (TStE 355, TStE 460, 15 MnNi 6.3). Moreover, results were obtained from long-term in-situ corrosion studies (maximum test duration 9 years) conducted on carbon steel, Ti 99.8-Pd, Hastelloy C4, Ni-resist D4, and Si-cast iron in boreholes in the Asse salt mine. (orig./MM)

27904 (LA-UR–94-1697) **High strain rate deformation of NiAl.** Maloy, S.A. (Los Alamos National Lab., NM (United States)); Gray, G.T. III; Darolia, R. Los Alamos National Lab., NM (United States). [1994]. 16p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-9406206–1: Intermetallics meeting, San Diego, CA (United States), 16-19 Jun 1994). Order Number DE94014810. Source: OSTI; NTIS; GPO Dep.

NiAl is a potential high temperature structural material. Applications for which NiAl is being considered (such as rotating components in jet engines) requires knowledge of mechanical properties over a wide range of strain rates. Single crystal NiAl (stoichiometric and Ni 49.75Al 0.25Fe) has been deformed in compression along [100] at strain rates of 0.001, 0.1/s and 2000/s and temperatures of 76,298 and 773K. <111> slip was observed after 76K testing at a strain rate of 0.001/s and 298K testing at a strain rate of 2000/s. Kinking was observed after deformation at 298K and a strain rate of 0.001/s and sometimes at 298 K and a strain rate of 0.1/s. Strain hardening rates of 8200 and 4000 MPa were observed after 773 and 298K testing respectively, at a strain rate of 2000/s. Results are discussed in reference to resulting dislocation substructure.

27905 (LA-UR–94-2272) **Non-Fermi Liquid scaling in UPd_xCu_{5-x}(x = 1,1.5).** Aronson, M.C. (Michigan Univ., Ann Arbor, MI (United States)); Osborn, R.; Robinson, R.A.; Lynn, J.W.; Chau, R.; Seaman, C.L.; Maple, M.B. Los Alamos National Lab., NM (United States). 28 Jun 1994. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-940863–3: International conference on strongly correlated electron systems, Amsterdam (Netherlands), 15-18 Aug 1994). Order Number DE94016072. Source: OSTI; NTIS; INIS; GPO Dep.

We have determined the inelastic magnetic response $S(\omega)$ of UPd_xcu_{5-x} (X=1,1.5) for temperatures from 0.3 to 300 K and energies between 05 and 400 meV using the neutron time of flight technique. $S(\omega)$ is virtually identical in the two compound, displaying marginal Fermi Liquid scaling over the entire range of temperatures, as well as scale invariant energetics.

27906 (LA-UR–94-2437) **Intense ion beam characterization and thermal modeling for beam materials processing.** Davis, H.A. (Los Alamos National Lab., NM (United States)); Rej, D.J.; Waganaar, W.J.; Johnston, G.P.; Ruiz, C.L.; Schmidlap, F.A. Los Alamos National Lab., NM (United States). [1994]. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-940634–14: 10. international conference on high power particle beams, San Diego, CA (United States), 20-24 Jun 1994). Order Number DE94016281. Source: OSTI; NTIS; INIS; GPO Dep.

The authors have developed an intense ion beam to investigate materials processing applications. Initial experiments have focused on thin film formation by depositing beam-ablated target material on substrates. Measurements of beam properties governing target ablation are presented here. Techniques include Thomson parabola particle spectroscopy to measure the ion beam atomic composition and the energy spectrum of each beam component, and thermal imaging to measure the beam incident energy density. Measurements are used as input to a computer model of the beam-target interaction. Comparison of computational results with target ablation and target energy absorption are found to be in good agreement.

27907 (LA-UR–94-2575) **4f bands in Ce heavy fermions and mixed valent compounds at $T \gg T_K$.** Andrews, A.B. (Los Alamos National Lab., NM (United States)); Joyce, J.J.; Arko, A.J.; Thompson, J.D.; Tang, J.; Fisk, Z.; Lawrence, J.M.; Riseborough, P.; Canfield, P.C. Los Alamos National Lab., NM (United States). [1994]. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-9408113–2: SCES '94, Amsterdam (Netherlands), Aug 1994). Order Number DE94016100. Source: OSTI; NTIS; GPO Dep.

We report evidence of 4f band character in Ce 4f states at $T \gg T_K$ using the technique of high-resolution angle-resolved resonant photoemission. The Ce intermetallic compound $CePt_{+x}$ was grown and studied in situ by the method of MBE and was characterized by LEED, XPS and XAS. These new findings would suggest a need for a reexamination of 4f photoemission in Ce compounds.

27908 (LA-UR–94-2627) **Zone refining of plutonium metal.** Blau, M.S. Los Alamos National Lab., NM (United States). Aug 1994. 107p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. Order Number DE94016194. Source: OSTI; NTIS; INIS; GPO Dep.

Thesis submitted to University of Idaho.

The zone refining process was applied to Pu metal containing known amounts of impurities. Rod specimens of plutonium metal were melted into and contained in tantalum boats, each of which was passed horizontally through a three-turn, high-frequency coil in such a manner as to cause a narrow molten zone to pass through the Pu metal rod 10 times. The impurity elements Co, Cr, Fe, Ni, Np, U were found to move in the same direction as the molten zone as predicted by binary phase diagrams. The elements Al, Am, and Ga moved in the opposite direction of the molten zone as predicted by binary phase diagrams. As the impurity alloy was zone refined, δ-phase plutonium metal crystals were produced. The first few zone refining passes were more effective than each later pass because an oxide layer formed on the rod surface. There was no clear evidence of better impurity movement at the slower zone refining speed. Also, constant or variable coil power appeared to have no effect on impurity movement during a single run (10 passes). This experiment was the first step to developing a zone refining process for plutonium metal.

27909 (NUREG–1426-Vol.2) **Compilation of reports from research supported by the Materials Engineering Branch, Division of Engineering: 1991–1993: Volume 2.** Hiser, A.L. (comp.). Nuclear Regulatory Commission, Washington, DC (United States). Materials Engineering Branch. Jun 1994. 31p. Sponsored by Nuclear Regulatory Commission, Washington, DC (United States). Source: OSTI; NTIS; INIS; GPO.

Since 1965, the Materials Engineering Branch, Division of Engineering, of the Nuclear Regulatory Commission's Office of Nuclear Regulatory Research, and its predecessors dating back to the Atomic Energy Commission (AEC), has sponsored research programs concerning the integrity of the primary system pressure boundary of light water reactors. The components of concern in these research programs have included the reactor pressure vessel (RPV), steam generators, and the piping. These research programs have covered a broad range of topics, including fracture mechanics analysis and experimental work for RPV and piping applications, inspection method development and qualification, and evaluation of irradiation effects to RPV steels. This report provides as complete a listing as practical of formal technical reports submitted to the NRC by the investigators working on these research programs. This listing includes topical, final and progress reports, and is segmented by topic area. In many cases a report will cover several topics (such as in the case of progress reports of multi-faceted programs), but is listed under only one topic. Therefore, in searching for reports on a specific topic, other related topic areas should be checked also. The separate volumes of this report cover the following periods: Volume 1: 1965–1990 and Volume 2: 1991–1993.

27910 (PNL-SA–24224) **Influence of transmutation on microstructure, density change, and embrittlement of vanadium and vanadium alloys irradiated in HFIR.** Ohnuki, S. (Hokkaido Univ., Sapporo (Japan)); Takahashi, H.; Shiba, K.; Hishinuma, A.; Pawel, J.; Garner, F.A. Pacific Northwest Lab., Richland, WA (United States); Oak Ridge National Lab., TN (United States). Jun 1994. 21p. Sponsored by USDOE, Washington, DC (United States);Ministry of Education, Science and Culture (Japan). DOE Contract AC06-76RL01830 ; AC05-84OR21400. (CONF-940657–4: 17. symposium on effects of radiation on materials, Sun Valley, ID (United States), 20-23 Jun 1994). Order Number DE94015202. Source: OSTI; NTIS; INIS; GPO Dep.

Addition of 1 at.% nickel to vanadium and V-10Ti, followed by irradiation along with the nickel-free metals in HFIR to 2.3×10^{22}n cm^{-2}, $E > 0.1$MeV (corresponding to 17.7 dpa) at 400 C, has been used to study the influence of helium on microstructural evolution and embrittlement. Approximately 15.3% of the vanadium transmuted to chromium in these alloys. The ~50 appm helium generated from the $^{58}Ni(n,\gamma)^{59}Ni(n,\alpha)^{56}Fe$ sequence was found to exert much less influence than either the nickel directly or the chromium formed by transmutation. The V-10Ti and V-10Ti-1Ni alloys developed an extreme fragility and broke into smaller pieces in response to minor physical insults during density measurements. A similar behavior was not observed in pure V or V-1Ni. Helium's role in determination of mechanical properties and embrittlement of vanadium alloys in HFIR is overshadowed by the influence of alloying elements such as titanium and chromium. Both elements have been shown to increase the ductile-to-brittle transition temperature (DBTT) rather rapidly in the region of 10% (Cr + Ti). Since Cr is produced by transmutation of V, this is a possible mechanism for the embrittlement. Large effects on the DBTT may have also resulted from uncontrolled accumulation of interstitial elements such as C, N, and O during irradiation.

27911 (SAND–94-1328C) **Pulsed Ion Beam Surface Treatment for preparing rapidly solidified corrosion resistant alloy surfaces.** Buchheit, R.G. (Sandia National Labs., Albuquerque, NM (United States)); Maestas, L.M.; McIntyre, D.C.; Stinnett, R.W.; Greenly, J.B. Sandia National Labs., Albuquerque, NM (United States). [1994]. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. (CONF-941063–1: 186. meeting of the Electrochemical Society, Miami, FL (United States), 9-14 Oct 1994). Order Number DE94012072. Source: OSTI; NTIS; GPO Dep.

IBEST (Ion BEam Surface Treatment) uses a series of 60 to 100 ns ion beam pulses to deposit energy in the topmost 2 to 20 μm of ametal surface to melt it. Areas as large as 1000 cm^2 can be treated by a single pulse. Treated regions that experienced melt were smoother after ion beam treatment. 2 figs, 1 tab, 2 refs.

27912 (UCRL-ID–117530) **WPH-6112A thermal expansion test of PRESS tubulation.** Kautz, D.D.; Sites, R.L.; Cobb, W.R. Lawrence Livermore National Lab., CA (United States). 26 May 1994. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. Order Number DE94015946. Source: OSTI; NTIS; GPO Dep.

We recently performed the WPH-6112A thermal expansion test of the lower portion of the PRESS program tubulation. The objective of the test was to determine whether the tubulation welds could withstand typical stresses from a 1200 C thermal cycle. Test

components failed in two areas: (1) the friction welded Monel to Vanadium tube fitting at the dissimilar metal interface and fell against the outer vanadium tube wall causing it to fail and (2) the thin-walled, outer stainless steel tubing failed by cracking at the weld. Both failures were due to irregular occurences for this system. We feel that the strength of all weldments is adequate to withstand the normal thermal stresses from a 1200 C cycle without failing prematurely.

27913 (UCRL-ID–117546) **Rocky Flats plant qualification testing for PRES Program.** Kautz, D.D.; Tanaka, G.J. Lawrence Livermore National Lab., CA (United States). 24 Jun 1994. 25p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. Order Number DE94016011. Source: OSTI; NTIS; GPO Dep.

The authors recently completed several tests for EG&G - Rocky Flats, Inc. (RFP) to qualify welding procedures for the PRESS program. The welds that were tested were the Monel 400 to vanadium friction weld used in the Sail-A and the vanadium electron beam welds from the Mast Inner Subassembly. Tests were performed to determine the structural properties of the parts under conditions similar to those encountered in a weapons handling and storage environment. These tests included impact, tensile and pressure loading. Metallographic analysis was done where appropriate to document weld quality. All results were satisfactory for PRESS program purposes.

27914 (UCRL-JC–117410) **Impurities in chromium deposits produced by electroplating and physical vapor deposition.** Dini, J.W. Lawrence Livermore National Lab., CA (United States). May 1994. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-9406219–1: American Society of Materials (ASM) AeroMat international meeting, Anaheim, CA (United States), 5-8 Jun 1994). Order Number DE94015715. Source: OSTI; NTIS; GPO Dep.

Impurity contents in electrodeposited (hexavalent and trivalent) chromium deposits and physically vapor deposited (thermal evaporation, electron beam evaporation and rf-sputtering) were compared. Oxygen is the key impurity obtained in electrodeposited films but it can be minimized in hexavalent plating solutions by operating at high temperature, e. g., 85 C. Electrodeposits produced in trivalent chromium plating solutions and physically vapor deposited films have much higher oxygen contents than electrodeposits produced in hexavalent chromium solutions operated at temperatures around 85 C. Depending on the target material used for physically vapor deposited films, these films can also have high amounts of other impurities.

27915 (WHC-SA–2261) **Irradiation performance of Fast Flux Test Facility drivers using D9 alloy.** Pitner, A.L.; Gneiting, B.C.; Bard, F.E. Westinghouse Hanford Co., Richland, WA (United States). Jun 1994. 26p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-940602–15: 35. annual meeting of the American Nuclear Society, New Orleans, LA (United States), 11-16 Jun 1994). Order Number DE94015711. Source: OSTI; NTIS; INIS; GPO Dep.

Six test assemblies similar in design to the FFTF driver assembly but employing the advanced alloy D9 in place of Type 316 stainless steel for duct, cladding, and wire wrap material were irradiated to demonstrate the improved performance and lifetime capability of this design. A single pinhole-type breach was incurred in one of the high exposure tests after a peak fuel burnup of 155 MWd/kgM and peak fast neutron fluence of 25 x 10^{22} n/cm^2 (E > 0.1 MeV). Postirradiation examinations were performed on four of the test assemblies and measured results were compared to analytical evaluations. A revised swelling correlation for D9 Alloy was developed to provide improved agreement between calculated and measured cladding deformation results. A fuel pin lifetime design criterion of 5% calculated hoop strain was derived. Alternatively, fuel pin lifetimes were developed for two irradiation parameters using statistical failure analyses. For a 99.99% reliability, the analyses indicated a peak fast fluence lifetime of 21.0 x 10^{22} n/cm^2, or a peak fuel burnup greater than 120 MWd/kgM. The extended lifetime capability of this design would reduce fuel supply requirements for the FFTF by a third relative to the reference driver design.

27916 (WHC-SA–2512) **Impact fracture behavior of HT9 duct.** Huang, F.H. (Westinghouse Hanford Co., Richland, WA (United States)); Gelles, D.S. Westinghouse Hanford Co., Richland, WA (United States). Jul 1994. 24p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE94016328. Source: OSTI; NTIS; INIS; GPO Dep.

Ferritic alloys are known to undergo a ductile-brittle transition as the test temperature is decreased. This inherent problem has limited their applications to reactor component materials subjected to low neutron exposures. However, the excellent resistance to void swelling exhibited by these alloys has led to choosing the materials as candidate materials for fast and fusion reactor applications. Despite the ductile-brittle transition problem, results show that the materials exhibit superior resistance to fracture under very high neutron fluences at irradiation temperatures above 380°C. Impact testing on FFTF duct sections of HT9 indicates that HT9 ducts have adequate fracture toughness at much higher temperatures for handling operations at room temperature and refueling operations.

27917 (WHC-SA–2513) **Transient failure behavior of HT9.** Huang, F.H. Westinghouse Hanford Co., Richland, WA (United States). Jul 1994. 15p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE94016320. Source: OSTI; NTIS; INIS; GPO Dep.

Alloy HT9 has-been chosen as candidate materials for fast and fusion reactor applications because the.material exhibits excellent resistance to void swelling. However, ferritic alloys are known to undergo a ductile-brittle transition as the test temperature is decreased. This inherent problem has limited their applications to reactor component materials subjected to low neutron exposures. Despite the ductile-brittle transition problem, results show that the materials exhibit superior resistance to fracture under very high neutron fluences at irradiation temperatures above 380C. Results also show that the transient behavior for HT9 cladding specimens taken from the fuel column region and cladding taken from outside the fuel column or unirradiated cladding are the same. HT9 cladding maintained its transient strength with irradiation to a fluence of 9 x 10^{22} n/cm^2 (E > 0.1 MeV).

27918 (WINCO–1219) **Long term laboratory corrosion monitoring of calcine bin set materials exposed to zirconia calcine.** Dirk, W.J. Westinghouse Idaho Nuclear Co., Inc., Idaho Falls, ID (United States). Jun 1994. 50p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-84ID12435. Order Number DE94015783. Source: OSTI; NTIS; INIS; GPO Dep.

Corrosion testing of Type 1025 carbon steel, 405, 304, 304L, 316L, and 347 stainless steels, and 6061-T6 aluminum were conducted in synthetic zirconia calcine to model long term corrosion performance of bin set material. Testing was conducted over a period of 17 years. The existing calcine bin set #1 is constructed of Type 405 stainless steel, 2 through 4 are constructed of Type 304 stainless steel and 5 through 7 are constructed of Type 304L stainless steel. The highest rate observed for Type 304L stainless steel was 8.1 x 10^{-7} inches per month. This would equal a wall thickness loss of about 5 mils after 500 years of storage. Currently, the established schedule for removal of corrosion test coupons from the calcine storage bins is at the end of the 10th, 100th, 250th, and 450th year of solid storage service. Very low corrosion rates and metal oxide data determined from the long term laboratory test, in conjunction with corrosion rates from the coupon assessment of the second bin set, indicate this schedule should be revised from 10 years to 50 years for the first assessment.

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Refer also to citation(s) 27580, 27905, 27946, 28010, 28100, 28364, 28786, 28796, 28832, 28858, 28872

27919 (ANL/ET/CP–82348) **Progress in development of tapes and magnets made from Bi-2223 superconductors.** Balachandran, U. (Argonne National Lab., IL (United States). Energy Technology Div.); Iyer, A.N.; Haldar, P.; Hoehn, J.G. Jr.; Motowidlo, L.R. Argonne National Lab., IL (United States). Energy Technology Div. May 1994. 19p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38.

(CONF-940627–3: 4. international conference and exhibition of the World Congress on Superconductivity, Orlando, FL (United States), 27 Jun - 1 jul 1994). Order Number DE94015067. Source: OSTI; NTIS; INIS; GPO Dep.

Long lengths of $(Bi,Pb)_2Sr_2Ca_2Cu_3O_x$ tapes made by powder-in-tube processing have been wound into coils. The performance of these coils has been measured at temperatures of 4.2 to 77 K. Microstructures have been examined by X-ray diffraction and electron microscopy and have been related to superconducting properties. A summary of recent results and an overview of future goals are presented.

27920 (ANL/MSD/CP–83051) **Phase separation and doped-hole segregation in $La_2CuO_{4+\delta}$ and $La_{2-x}Sr_xCuO_{4+\delta}$.** Johnston, D.C. (Ames Lab., IA (United States)); Bayless, W.R.; Borsa, F. Argonne National Lab., IL (United States). May 1994. 5p. Sponsored by USDOE, Washington, DC (United States);National Science Foundation, Washington, DC (United States). DOE Contract W-31109-ENG-38. Grant 91-20000. (CONF-940701–15: Meeting on materials and mechanisms of superconductivity: high temperature superconductors, Grenoble (France), 4-9 Jul 1994). Order Number DE94015070. Source: OSTI; NTIS; GPO Dep.

This paper reviews the magnetic, superconducting and structural phase diagrams of the title systems, with an emphasis on recent results from magnetic and structural neutron diffraction, magnetic susceptibility and ^{139}La nuclear quadrupole resonance measurements. Results clarify the miscibility gap in the $La_2CuO_{4+\delta}$ system and indicate the occurrence of frustrated phase separation on a nanoscopic length scale in the $La_{2-x}Sr_xCuO_4$ system with $0 < x \lesssim 0.05$.

27921 (ANL/MSD/PP–81187) **Transport resistive broadening by avalanche flux motion in high-temperature superconductors: SOC in a driven system.** Wang, Zuning (Argonne National Lab., IL (United States)); Shi, Donglu. Argonne National Lab., IL (United States). Oct 1993. 15p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. Order Number DE94016901. Source: OSTI; NTIS; GPO Dep.

Characteristics of seff -organized criticality (SOC) are investigated for a driven system in high-Tc supercorductors. By applying a bias current to a single crystal of $Bi_2Sr_2CaCu_2O_x$, we are able to drive the vortex state to criticality. We establish a magnetic field profile for a type-II superconductor by considering both the magnetic force (caused by the Bean critical current) and the Lorentz force (associated with the bias currrent). The resistive broadening is interpreted in the framework of SOC. We show that the R vs. T curve is divided into regions of flux flow, thermally activated flux avalanche creep.

27922 (BNL–60437) **Ferromagnetic grain boundary signature in die-upset RE-Fe-B magnets.** Henderson Lewis, L.; Zhu, Y.; Welch, D.O. Brookhaven National Lab., Upton, NY (United States). [1994]. 14p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH00016. (CONF-9406204–1: Acta metallurgical meeting on novel magnetic structures and properties, Santa Fe, NM (United States), 24-25 Jun 1994). Order Number DE94014904. Source: OSTI; NTIS; GPO Dep.

Previous nanostructural and nanocompositional studies performed on the boundaries of deformed grains in two die-upset rare earth magnets with bulk compositions $Nd_{13.75}Fe_{80.25}B_6$, and $Pr_{13.75}Fe_{80.25}B_6$ indicate that the intergranular phase in many grain boundaries is enriched in iron relative to the bulk. Preliminary magnetic data are presented that provide further evidence that this grain boundary phase is indeed iron-rich, and in fact appears to be ferromagnetic. Hysteresis loops were performed at 800 K on die-upset magnets with the above compositions. Each sample showed a clear hysteresis with coercivities between 34 and 40 Oe average remanence $4\pi M_R$ of 6.8 G for the Nd-based sample and 10.3 G for the Pr-based sample. The ferromagnetic signals measured at high temperature in these magnets are attributed to the iron-rich grain boundary phase. The implications of this conclusion with respect to coercivity are discussed.

27923 (DOE/ER/54160–1-Vol.3, pp. 1954-1959) **High energy electron beam materials processing.** Stark, R.A. (Naval Surface Warfare Center, Silver Spring, MD (United States)); Schneider, R.F.; Nolting, E.E.; Skopec, M.; Danko, J.C.; Lundin, C.D.; Meek, T.T. Maryland Univ., College Park, MD (United States). [1992]. (CONF-920515–Vol.3: 9. international conference on high power particle beams, Washington, DC (United States), 25-29 May 1992). In *Beams 92: Proceedings: Volume 3, Microwaves, Free electron lasers, Advanced accelerators, Applications, and Plasma discharges.* 681p. Order Number DE94014785. Source: OSTI; NTIS; INIS.

High energy ($\geq$1 MeV), pulsed electron beams are capable of rapid, in-depth energy deposition in materials. This feature should yield some significant advantages in the processing of materials. This report describes preliminary experiments using this technology for the joining via brazing of carbon-carbon and metal-matrix composites, and the bonding and sintering of ceramics. The experiments described are being conducted utilizing a high energy (1.5 - 3.0 MeV), high current ($\lesssim$ 3 kA), long pulse (0.2 - 2.0 μs) electron beam produced by the Naval Surface Warfare Center's Long Pulse Accelerator. Initial results and extensive numerical modeling indicate the advantages of using a beam delivering a train of much shorter pulses over a longer time. The deposition of energy over much longer times avoids large pressures which can cause material damage. Also, for brazing applications, some heating of the base materials by the braze during beam exposure is desirable.

27924 (DOE/ER/54160–1-Vol.3, pp. 1966-1970) **High-rate deposition of thin films by high-power ion beam.** Isakov, I.F. (Nuclear Physics Institute, Tomsk (Russian Federation)); Remnev, G.E.; Zakutayev, A.N. Maryland Univ., College Park, MD (United States). [1992]. (CONF-920515–Vol.3: 9. international conference on high power particle beams, Washington, DC (United States), 25-29 May 1992). In *Beams 92: Proceedings: Volume 3, Microwaves, Free electron lasers, Advanced accelerators, Applications, and Plasma discharges.* 681p. Order Number DE94014785. Source: OSTI; NTIS; INIS.

The results on the deposition of thin elemental and compound films by means of a high-power ion beam are presented. The TEMP accelerator (an ion energy of 300 keV, a current density of 100-150 A/cm^2 on a target, a pulse repetition rate of 0.3 Hz, a vacuum of 10^{-4} Torr) was used. The thin metallic (Cd, Zn, and other) and stoichiometric Y_1-Ba_2-Cu_3-O_{7-x} films were obtained. The film growth rate was $(0.3\text{-}1)\cdot10^8$ Å/s. The results show (i) the metallic films were continuous with very smooth surface morphology when they were examined by scanning electron microscopy, and (ii) transmission electron diffraction and transmission electron microscopy indicated small grain polycrystalline metallic films, and (iii) by Rutherford backward scattering and Auger electron spectroscopy it is shown that the stoichiometric Y_1-Ba_2-Cu_3-O_{7-x} films can be deposited at relatively low substrate temperature ~300-450°C.

27925 (DOE/ER/54160–1-Vol.3, pp. 1971-1976) **Quick preparation of thin films and characteristics of ablation plasma produced by ion-beam evaporation.** Sonegawa, T. (Nagaoka Univ. of Technology, Niigata (Japan)); Kang, X.D.; Hoshino, H.; Ohashi, M.; Musagata, K.; Yatsui, K.; Shimotori, Y.; Furuuchi, S. Maryland Univ., College Park, MD (United States). [1992]. (CONF-920515–Vol.3: 9. international conference on high power particle beams, Washington, DC (United States), 25-29 May 1992). In *Beams 92: Proceedings: Volume 3, Microwaves, Free electron lasers, Advanced accelerators, Applications, and Plasma discharges.* 681p. Order Number DE94014785. Source: OSTI; NTIS; INIS.

An intense, pulsed, light-ion beam (LIB) can be used to produce high density "ablation" plasma when the LIB is irradiated on the solid targets. For this case, the LIB can be considered as the effective heat source since the pulse width is short compared to thermal conduction time. Using the above plasma, the authors have succeeded in quick preparation of thin films by "ion-beam evaporation" (IBE). Diamond-like carbon films have been successfully prepared on the silicon substrate kept at room temperature by using graphite target. Furthermore, various films were made such as ZnS, ZnS:Mn, B, ITO, YBaCuO, $BaTiO_3$, BN, YSZ, apatite, and so on. The instantaneous deposition rate has been typically estimated on the order of several cm/s. The characteristics of the films prepared have been studied in detail. In connection with the properties of the

films studied above, several diagnostics have been carried out on the characteristics of the ablation plasma by time-resolved spectroscopic measurement by using Streak camera, where fully ionized, high-density plasma has been found to be produced.

27926 (DOE/PC/92111–5) **Conversion of light hydrocarbon gases in metal carbides for production of liquid fuels and chemicals: Quarterly technical status report, October 1–December 31, 1993.** Diaz, A.F.; Modestino, A.J.; Howard, J.B.; Tester, J.W.; Peters, W.A. Massachusetts Inst. of Tech., Cambridge, MA (United States). Feb 1994. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC22-92PC92111. (FE-MIT–92111-5). Order Number DE94013933. Source: OSTI; NTIS; GPO Dep.

The plasma gun was redesigned, after accidental burn-out in the previous period, to eliminate any possible arcing pathways outside of the inter-electrode region. A stable Argon arc discharge was obtained during the first test-firing of the completely rebuilt gun. The system flow capacity was determined to be about 3 cfm at ambient conditions. Procurement and installation of process and safety monitoring devices and of components of the sample collection system are in progress. The gas-quenched and water-cooled sample collection probe is fully assembled and is ready for installation. Shakedown-testing of the thermal plasma reactor has also commenced. Debottlenecking work on the gas and cooling water lines was performed to relieve excessive pressure drop through both gas and cooling water systems. For the next period, the shakedown testing will proceed first with the determination of the maximum power levels at which the plasma reactor can be operated at each gas flowrate, with Argon as the plasma-forming gas. The next step will be to complete the assembly of the sample collection system and to check out the entire system to determine other process constraints, first without firing, and then, with firing, still utilizing Argon as plasma gas. Preliminary temperature profile measurements in the cooling chamber will be taken using thermocouples to map out a safe penetration length of the sample collection probe into the chamber. Once the shakedown-testing is completed, the Miller powder feeder will be procured on a trial basis and preliminary scoping runs with methane and CaO and with methane and MgO will be performed.

27927 (FRCEA-TH–397) **Study under pressure of heavy fermion URu_2Si_2.** Schmidt, L. CEA Centre d'Etudes de Grenoble, 38 (France). Dept. de Recherche Fondamentale sur la Matiere Condensee; Grenoble-1 Univ., 38 (France). Nov 1993. 109p. (In French). Order Number DE94631916. Source: OSTI; NTIS (US Sales Only); INIS.

The object of this thesis is to study the resistivity of heavy fermions compound URu_2Si_2 in the range of temperature varying from 35 milli K and 300 K. Two exterior parameters, a magnetic field varying between 0 and 15 T and a hydrostatic pressure varying between 0 and 70 kbar, are used to create conditions we want. Antiferromagnetic phase and superconductivity are studied and exposed.

27928 (INIS-mf–14293) **1990 annual report of the ultra-high superconductivity project.** Bucher, E.; Anghel, A.; Liebemann, E.; Hohl, H. Konstanz Univ. (Germany). Fakultaet fuer Physik. [1993]. 8p. (In German). Sponsored by Bundesministerium fuer Forschung und Technologie, Bonn (Germany). Foerderkennzeichen BMFT 13N5689. Order Number DE94787001. Source: OSTI; NTIS (US Sales Only); INIS.

The project was intended to achieve novel materials with ultra-high superconducting properties. The synthesis and analysis of various specimens finally resulted in the preparation of the following compounds: $Ln_2SrCu_2O_8$ (Ln = La-Gd), $Pr_{2-x}Sr_{1+x}Cu_2O_6$; $Pr_{2-x}Sr_xCaCu_2O_6$, $Ag_5Pb_{2-x}Bi_xO_6$; $Tl_2Ba_2CuO_6$, $Ba_{1-x}La_xNbO_3$. (MM)

27929 (JAERI-M–94-001) **Development of oxidation resistant SiC/C compositionally gradient materials.** Fujii, Kimio (Japan Atomic Energy Research Inst., Tokai, Ibaraki (Japan). Tokai Research Establishment); Nakano, Junichi; Shindo, Masami. Japan Atomic Energy Research Inst., Tokyo (Japan). Jan 1994. 20p. Order Number DE94785101. Source: OSTI; NTIS; INIS.

For the evaluation of oxidation characteristic for the trial production of SiC/C compositionally gradient carbon and SiC/C compositionally gradient carbon fiber reinforced carbon (CFRC) materials, which are composed of a surface SiC coating layer, an intermediate SiC/C layer and substrate material, the oxidation test in air at 800degC for up to 100 h was performed compared with each other three kinds version, i.e., substrate material, one with intermediate SiC/C layer and one coated by SiC layer. It was shown that SiC/C compositionally gradient material exhibited the best oxidation resistance among each substrate series, and the conception of SiC/C compositionally gradient material could be applied to carbon and CFRC materials as well as graphite material. (author).

27930 (LBL–35660) **Comparison of AlN films grown by RF magnetron sputtering and ion-assisted molecular beam epitaxy.** Chan, J.; Fu, T.; Cheung, N.W.; Ross, J.; Newman, N.; Rubin, M. Lawrence Berkeley Lab., CA (United States). Apr 1993. 6p. Sponsored by USDOE, Washington, DC (United States);Department of Defense, Washington, DC (United States). DOE Contract AC03-76SF00098. Contract F49620-90-C-0029. (CONF-930405–56: Spring meeting of the Materials Research Society, San Francisco, CA (United States), 12-16 Apr 1993). Order Number DE94014914. Source: OSTI; NTIS; GPO Dep.

Crystalline aluminum nitride (AlN) thin films were formed on various substrates by using RF magnetron sputtering of an A1 target in a nitrogen plasma and also by ion-assisted molecular beam epitaxy (IAMBE). Basal-oriented AlN/(111) Si showed a degradation of crystallinity with increased substrate temperature from 550 to 770 C, while the crystallinity of AlN/(0001) $A1_2O_3$ samples improved from 700 to 850 C. The optical absorption characteristics of the AlN/(0001) $A1_2O_3$ films as grown by both deposition methods revealed a decrease in subbandgap absorption with increased substrate temperature.

27931 (ORNL/TM–12646) **The Ceramic Manufacturability Center: A new partnership with US industry.** Tennery, V.J. (Oak Ridge National Lab., TN (United States)); Morris, T.O. Oak Ridge National Lab., TN (United States); Oak Ridge Y-12 Plant, TN (United States). Dec 1993. 49p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE94015851. Source: OSTI; NTIS; GPO Dep.

The Ceramic Manufacturability Center (CMC) is a new facility at the Oak Ridge National Laboratory (ORNL) established as a direct response to current US industry needs. It was created as part of a highly integrated program jointly funded by the US Department of Energy Defense Programs, Energy Efficiency and Renewable Energy, and Energy Research divisions. The CMC is staffed by personnel from ORNL and the Y-12 Plant, both managed by Martin Marietta Energy Systems, Inc. (Energy Systems). Its mission is to improve the technology needed to manufacture high-precision ceramic components inexpensively and reliably. This mission can be accomplished by strengthening the US machine tool industry and by joining with ceramic material suppliers and end users to provide a path to commercialization of these ceramic components.

27932 Microwave sintering of multiple articles. Blake, R.D.; Katz, J.D. To Dept. of Energy. 1992. Filed date 31 Jul 1992. U.S. Patent Application 7-923,298. 14p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. Order Number DE94016126. Source: OSTI; NTIS; GPO Dep.

Disclosed are apparatus and method for producing articles of alumina and of alumina and silicon carbide in which the articles are sintered at high temperatures using microwave radiation. The articles are placed in a sintering container which is placed in a microwave cavity for heating. The rates at which heating and cooling take place is controlled.

27933 (SAND–94-1279) **Superconducting Technology Program: Sandia 1993 annual report.** Roth, E.P. (Sandia National Labs., Albuquerque, NM (United States). Superconductivity Materials and Optical Properties Dept.). Sandia National Labs., Albuquerque, NM (United States). May 1994. 83p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. Order Number DE94015601. Source: OSTI; NTIS; INIS; GPO Dep.

Sandia's STP program is a four-part high-temperature superconductor (HTS) research and development program consisting of efforts in powder synthesis and process development, thallium-based HTS film development, wire and tape fabrication, and HTS motor design. The objective of this work is to develop high-temperature superconducting conductors (wire and tape) capable of meeting requirements for high-power electrical devices of interest to industry. The four research efforts currently underway are: (1) process research on the material synthesis of high-temperature superconductors; (2) investigation of the synthesis and processing of thallium-based high-temperature superconducting thick films; (3) process development and characterization of high-temperature superconducting wire and tape, and (4) cryogenic design of a high-temperature superconducting motor. This report outlines the research that has been performed during FY93 in each of these four areas. A brief background of each project is included to provide historical context and perspective. Major areas of research are described, although no attempt has been made to exhaustively include all work performed in each of these areas.

27934 (SAND–94-1305C) **Ceramic manufacturing: Optimizing a multivariable system.** Readey, M.J. Sandia National Labs., Albuquerque, NM (United States). [1994]. 16p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. (CONF-940416–20: 96. annual meeting of the American Ceramic Society, Indianapolis, IN (United States), 24-28 Apr 1994). Order Number DE94015016. Source: OSTI; NTIS; GPO Dep.

Ceramics offer significant performance advantages over other engineering materials in a great number of applications such as turbocharger rotors and wear components. However, to realize their full market potential, ceramics must become more cost competitive. One way to achieve such competitiveness is to maximize manufacturing yield via process optimization. One simple optimization strategy involves maximizing yield by decreasing product variability (e.g., by operating in a regime that is inherently process tolerant). This paper extends this concept to the simultaneous optimization of many material characteristics, which is more typical of the requirements of a real ceramic manufacturing operation.

27935 (SAND–94-1629C) **Relationships between ferroelectric 90° domain formation and electrical properties of chemically prepared $Pb(Zr,Ti)O_3$ thin films.** Tuttle, B.A.; Garino, T.J. Voigt, J.A.; Headley, T.J.; Dimos, D.; Eatough, M.O. Sandia National Labs., Albuquerque, NM (United States). [1994]. 20p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. (CONF-9406220–1: North Atlantic Treaty Organization (NATO) advanced research workshop on electroceramic films, Villa Del Mar (Italy), 20 Jun 1994). Order Number DE94015274. Source: OSTI; NTIS; GPO Dep.

For PZT films deposited on Pt coated substrates, remanent polarization is a monotonic function of thermal expansion of the substrate, a result of 90° domain formation occurring as the film is cooled through the transformation temperature. PZT film stress in the vicinity of the Curie point controls 90° domain assemblages within the film. PZT films under tension at the transformation temperature area-domain oriented; whereas, films under compression at the transformation temperature are c-domain oriented. From XRD electrical switching of 90° domains is severely limited. Thus, formation of these 90° domains in vicinity of the Curie point is dominant in determination of PZT film dielectric properties. Chemically prepared PZT thin films with random crystallite orientation, but preferential a-domain orientation, have low remanent polarization (24 $\mu C/cm^2$) and high dielectric constant (1000). Conversely, PZT films of similar crystalline orientation, but of preferential c-domain orientation, have large remanent polarizations (37 $\mu C/cm^2$) and low dielectric constants (700). This is consistent with single-crystal properties of tetragonally distorted, simple perovksite ferroelectrics. Further, for our films that grain size - 90° domain relationships appear similar to those in the bulk. The effect of grain size on 90° domain formation and electrical properties are discussed.

27936 (SAND–94-1669C) **Structure-property relationships in sol-gel-derived thin films.** Brinker, C.J. (Sandia National Labs., Albuquerque, NM (United States). Ceramic Synthesis and Inorganic Chemistry Dept.); Raman, N.K.; Sehgal, R.; Hua, D.W.; Ward, T.L.; Logan, M.N.; Assink, R.A. Sandia National Labs., Albuquerque, NM (United States). [1994]. 22p. Sponsored by USDOE, Washington, DC (United States);National Science Foundation, Washington, DC (United States);Electric Power Research Inst., Palo Alto, CA (United States);Gas Research Inst., Chicago, IL (United States). DOE Contract AC04-94AL85000. (CONF-930304–33: 205. American Chemical Society national meeting, Denver, CO (United States), 28 Mar - 2 apr 1993). Order Number DE94016149. Source: OSTI; NTIS; GPO Dep.

The molecular-scale species distributions and intermediate-scale structure of silicate sols influence the microstructures of the corresponding thin films prepared by dip-coating. Using multi-step hydrolysis procedures, the authors find that, depending on the sequence and timing of the successive steps, the species distributions (determined by ^{29}Si NMR) and intermediate scale structure (determined by SAXS) can change remarkably for sols prepared with the same nominal composition. During film formation, these kinetic effects cause differences in the efficiency of packing of the silicate species, leading to thin film structures with different porosities.

27937 (UCRL-CR–117234) **Superplasticity and superplastic forming of ceramics.** Nieh, T.G.; Wadsworth, J. Lawrence Livermore National Lab., CA (United States). May 1994. 12p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. Order Number DE94016172. Source: OSTI; NTIS; GPO Dep.

Recent advances in the basic understanding of superplasticity and superplastic forming of ceramics are reviewed. Deformation mechanisms as well as microstructural requirements for superplastic ceramics are discussed. Microstructural effects, such as grain size, dynamic grain growth, and the presence of grain-boundary liquid phases, on the superplastic properties and deformation behavior of ceramics are addressed. Superplastic forming, and particularly biaxial gas-pressure forming, of several ceramics, including YTZP and Al_2O_3/YTZP, is also presented. The forming behavior of these ceramics is correlated with that obtained from conventional uniaxial tests. Examples of concurrent superplastic forming and diffusion bonding (SPF/DB) of metal-ceramic hybrids are given.

27938 (UCRL-JC–117504) **Core-level spectroscopy of thin oxides and oxynitrides.** Himpsel, F.J. (International Business Machines Corp., Yorktown Heights, NY (United States). Thomas J. Watson Research Center); Akatsu, H.; Carlisle, J.A. Lawrence Livermore National Lab., CA (United States). 19 Jul 1994. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-940529–20: 185. Electrochemical Society meeting, San Francisco, CA (United States), 22-27 May 1994). Order Number DE94016598. Source: OSTI; NTIS; GPO Dep.

Several spectroscopic methods are discussed that use core levels, such as photoelectron spectroscopy and absorption spectroscopy with photoelectron or fluorescence detection. Measurements are presented on the desorption of a chemical oxide and the growth of oxynitrides with N_20 on Si(100). The stoichiometry is found to change strongly with thickness, from a nitrogen-terminated Si surface to a nearly-pure oxide in the outer region of 40–60 Å films. Using a third generation synchrotron beam line a sensitivity of better than a tenth of a monolayer is achieved by a simple photocurrent measurement.

3606 Other Materials

Refer also to citation(s) 27330, 27331, 27345, 27389, 27402, 27594, 27596, 27597, 27598, 27599, 27600, 27601, 27602, 27699, 27870, 27882, 27887, 27895, 27905, 27922, 27924, 27928, 27936, 27985, 27987, 28081, 28090, 28297, 28777, 28832, 28848

27939 (ANL/BIM/PP–77640) **Dynamic light scattering investigations of a new class of polyethyleneimine derivatives.** Budzynski, D.M. (Illinois Univ., Chicago, IL (United States). Dept. of Chemistry); Benight, A.S.; Myatt, E.A. Argonne National Lab., IL (United States). [1992]. 10p. Sponsored by USDOE, Washington, DC (United States);National Science Foundation, Washington, DC

(United States). DOE Contract W-31109-ENG-38. Grant DMB-9018782. Order Number DE94016390. Source: OSTI; NTIS; GPO Dep.

Dynamic light scattering measurements were performed on polyethyleneimine and several chemically modified derivatives that differ in site, degree of substitution, and chemical nature of alkyl substituents. Moreover, two of the six polymer derivatives were acetylated for amine charge neutralization. Dynamic light scattering results indicate that the unmodified polymers assume the most extended and probably most highly aggregated structure in aqueous solution (100 mM Tris-HCl, pH = 6.8). Attachment of decyl groups on the primary amines has little effect on the solution properties of the polyethyleneimine polymers; these modified polymers are most similar to the unmodified polymers. In contrast, attachment of dodecyl or dodecylbenzyl groups on the tertiary amines induces the polymers to contract.In addition these polymers do not seem to aggregate as extensively as the unmodified polymers. Results demonstrate the utility of dynamic light scattering measurements to provide novel insight into effects of relative hydrophobicity of polyethyleneimine polymers on their extension and aggregation tendencies in aqueous solution. These results may provide a basis for understanding the enzymatic properties of polyethyleneimine polymers.

27940 (ANL/MSD/CP–83658) **Self-organization of graft copolymers at surfaces, interfaces and in bulk.** Rabeony, M. (Exxon Research and Engineering Co., Annandale, NJ (United States)); Peiffer, D.G.; Behal, S.K.; Disko, M.; Dozier, W.D.; Thiyagarajan, P.; Lin, M.Y. Argonne National Lab., IL (United States). Jul 1994. 22p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. Order Number DE94016884. Source: OSTI; NTIS; GPO Dep.

The morphology in bulk and thin film of high-integrity graft copolymers has been investigated by small angle neutron and light scattering, neutron reflectivity, and transmission electron microscopy. The model graft copolymers are based on two chemically incompatible-blocks composed of an elastomeric polyethylacrylate backbone onto which pendant monodisperse thermoplastic polystyrene are statistically placed. Two different levels of graft corresponding to an average of 1 and 3 per chain were investigated. In the bulk phase, the low graft level shows irregular fractal-like structures while the high graft level exhibits lamellar microdomains. In thin film, ordered structures were observed also in both compositions. The interphase adhesion between the polystyrene and the polyethylacrylate microdomain was investigated by uniaxially elongating the copolymer films. The low level graft material exhibits normal behavior characteristic of filler-reinforced rubber: the isotropic scattering pattern deforms in an anisotropic manner, i.e., ellipsoid-shaped with the long axis perpendicular to the stretching direction. An "abnormal Butterfly" pattern was observed with the high graft level. The butterfly pattern is attributed to the deformation of the lamellar morphology of the copolymer.

27941 (BNL–60538) **Observation of diffraction effects in positron channeling.** Palathingal, J.C. (Univ. of Puerto Rico, Mayaguez (Puerto Rico)); Peng, J.P.; Lynn, K.G.; Wu, X.Y.; Schultz, P.J. Brookhaven National Lab., Upton, NY (United States). [1994]. 5p. Sponsored by USDOE, Washington, DC (United States);National Science Foundation, Washington, DC (United States). DOE Contract AC02-76CH00016. Grant PHY-9203873. (CONF-9405170–6: 10. international conference on positron annihilation, Beijing (China), 23-29 May 1994). Order Number DE94014909. Source: OSTI; NTIS; INIS; GPO Dep.

An experimental investigation of positron channeling was made with a high-angular resolution apparatus, employing positrons of kinetic energy 1 MeV, derived from the Brookhaven National Laboratory Dynamitron. The pattern of transmission through a Si (100) single crystal of thickness 0.245 μm was investigated for a number of major planes. The authors have observed for the first time, in excellent detail, the fine structure of the channeling pattern expected to arise from the particle diffraction effects, theoretically explainable in terms of the quantum-mechanical many-beam calculations.

27942 (BNL–60588) **Defect profiling in elemental and multilayer systems: Correlations of fitted defect concentrations with positron implantation profiles.** Ghosh, V.J.; Nielsen, B.; Lynn, K.G.; Welch, D.O. Brookhaven National Lab., Upton, NY (United States). [1994]. 15p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH00016. (CONF-9405198–1: 6. international workshop on slow-positron beam techniques for solids and surfaces (SLOPOS6), Makuhari (Japan), 18-22 May 1994). Order Number DE94015844. Source: OSTI; NTIS; GPO Dep.

The results of several positron annihilation (Doppler broadening) experiments have been analyzed using the BNL Monte Carlo implantation profiles and the program VEPFIT. The program VEPFIT has been modified so that scaled, parameterized multilayer profiles can also be used as the initial condition for the diffusion equation solution. The authors have looked at both elemental (e.g. amorphous silicon) and multilayer (e.g. Pd/Si) system. Strong correlations between the input implantation profile parameters and the fitted values obtained for the diffusion lengths and overlayer thicknesses for the multilayer systems have been found. The effect of uncertainties in the mean depth on the value of the diffusion length and hence the defect concentrations will be discussed. The impact of reimplanting backscattered positrons on both the implantation profiles and the fitted diffusion lengths will also be presented.

27943 (CONF-940399–1) **Life prediction for bridged fatigue cracks.** Cox, B.N. Rockwell International Corp., Thousand Oaks, CA (United States). Science Center. [1994]. 42p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG03-89ER45400. From Life prediction methodology for titanium matrix composites symposium; Hilton Head, SC (United States); 22-24 Mar 1994. Order Number DE94016000. Source: OSTI; NTIS; GPO Dep.

One of the more promising classes of composites touted for high temperature applications, and certainly the most available, is that of relatively brittle matrices, either ceramic or intermetallic, reinforced by strong, aligned, continuous fibers. Under cyclic loading in the fiber direction, these materials develop matrix cracks that often run perpendicular to the fibers, while the fibers remain intact in the crack wake, supplying bridging tractions across the fracture surfaces. The bridging tractions shield the crack tip from the applied load, dramatically reducing the crack velocity from that expected in an unreinforced material subjected to the same value, ΔK_a, of the cyclic applied stress intensity factor. An important issue in reliability is the prediction of the growth rates of the bridged cracks. The growth rates of matrix fatigue cracks bridged by sliding fibers are now commonly predicted by models based on the micromechanics of frictional interfaces. However, there exist many reasons, both theoretical and experimental, for suspecting that the most popular micromechanical models are probably wrong in detail in the context of fatigue cracks. Furthermore, a review of crack growth data reveals that the validity of the micromechanics-based predictive model has never been tested and may never be tested. In this paper, two alternative approaches are suggested to the engineering problem of predicting the growth rates of bridged cracks without explicit recourse to micromechanics. Instead, it is shown that the material properties required to analyze bridging effects can be deduced directly from crack growth data. Some experiments are proposed to test the validity of the proposals.

27944 (DOE/CE/23810–42A) **Thermophysical properties of HCFC alternatives: Quarterly report, 1 April 1994–30 June 1994.** Haynes, W.M. National Inst. of Standards and Technology, Boulder, CO (United States). Thermophysics Div. Jul 1994. 6p. Sponsored by USDOE, Washington, DC (United States);Air-Conditioning and Refrigeration Technology Inst., Inc., Arlington, VA (United States). DOE Contract FG02-91CE23810. Project 660-50800. Order Number DE94016646. Source: OSTI; NTIS; GPO Dep.

Numerous fluids and fluid mixtures have been identified as promising alternatives to the HCFC refrigerants, but, for many of them, reliable thermodynamic data do not exist. Reliable thermodynamic properties data and models are needed to predict the performance of the new refrigerants in heating and cooling equipment and to design and optimize equipment to be reliable and energy efficient. The objective of this project is to measure, with high accuracy, selected thermodynamic properties data for two pure refrigerants and nine refrigerant blends; these data will be

used to fit equations of state and other property models which can be used in equipment design. The new data will fill in gaps in the existing data and resolve problems and differences that exist in and between existing data sets. Most of the studied fluids and blends are potential replacements for HCFC-22 and/or R502; in addition, one pure fluid and one blend are potential replacements for CFC-13 in low temperature refrigeration applications.

27945 (DOE/ER/13974–T2) **Adsorption and diffusion of fluids in well-characterized adsorbent materials: [Annual] progress report, August 1, 1993–July 31, 1994.** Gubbins, K.E. Cornell Univ., Ithaca, NY (United States). [1994]. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-88ER13974. Order Number DE94016953. Source: OSTI; NTIS; GPO Dep.

During this period, work has included molecular simulations for simple gases in well-characterized materials (carbons, aluminophosphates, buckytubes, pillared clays, MCM-41 zeolite), water in carbons and aluminophosphates, and chain molecules in carbons.

27946 (DOE/ER/45366–6) **[The structural basis for fatigue failure initiation in glassy polymers]: Progress report, July 1991–October 1993.** Yee, A.F. Michigan Univ., Ann Arbor, MI (United States). [1993]. 16p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-88ER45366. Order Number DE94015415. Source: OSTI; NTIS; GPO Dep.

In this period efforts were devoted to studying the microstructural elements characterizing fatigue failure initiation, their evolution as a function of fatigue history, and role of external variables. Materials studied include polycarbonate (PC) and its derivatives with different relaxation behaviors, and epoxies with different cross-link densities. The majority of the studies were devoted to PC. Techniques used included mechanical testing, volumetry, density, DSC, x-ray scattering, positron annihilation, TEM, etc. Results suggest that craze initiation starts with expansion of "elementary" voids; that fatigue failure initiation in bulk, amorphous PC is generation of stable voids or "proto-crazes"; that sizes of initial voids are generally in the range of tens of nanometers; that growth of proto- crazes into mature crazes occurs through expansion of voids and generation of new ones perpendicular to fatigue stress; and that fatigue craze initiation in bulk, amorphous PC even at below T_g may involve disentanglement of polymer chains.

27947 (DOE/ER/45400–T6) **Mechanisms of mechanical fatigue in ceramics: Annual technical progress report No. 4, August 15, 1992–August 14, 1993.** Cox, B. Rockwell International Corp., Thousand Oaks, CA (United States). Science Center. Jul 1994. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG03-89ER45400. Order Number DE94016040. Source: OSTI; NTIS; GPO Dep.

This report covers work done in the second year of the three-year follow-on contract. Theme of our work in this period continued to be the theory and measurement of rate-dependent bridging phenomena in fracture and fatigue. This covers both room temperature phenomena such as cycle-dependent attrition of crack bridging ligaments and high temperature phenomena such as viscosity and creep in bridging or cohesive zones. Our theoretical work focused on analytical solutions to rate dependent bridging problems. Our experimental work focused on developing high temperature in situ imaging methods. We obtained our first crack opening displacement measurements at elevated temperature in a graphite/SiC composite.

27948 (EGG-MS–11063) **A theoretical study of 30 to 50 angstrom noble gas heavy ion lithography.** Nelson, C.B.; Makowitz, H. EG and G Idaho, Inc., Idaho Falls, ID (United States). Feb 1994. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE94015262. Source: OSTI; NTIS; INIS; GPO Dep.

The feasibility of using heavy noble gas ions to etch 30 to 50 Å wide lines in polymethylmethacrylate (PMMA) on a silicon substrate was investigated. The TRIM91 computer code was used to model point sources of neon, argon, xenon, krypton, or uranium ions penetrating a two-dimensional geometry consisting of a 50 Å layer of PMMA over a 50 Å layer of silicon. For ions with a kinetic energy less than 500 e, the energy deposition is so confined that the proximity effect is virtually nonexistent. These and other considerations indicate that heavy noble gas ions may be ideal for etching angstrom-level features in this geometry.

27949 (KAPL–4777) **Ru_2Ge_3: Crystal growth and some properties.** Borshchevsky, A. (California Inst. of Tech., Pasadena, CA (United States). Jet Propulsion Lab.); Fleurial, J.P. Knolls Atomic Power Lab., Schenectady, NY (United States). Oct 1993. 14p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC12-76SN00052. (CONF-930851–3: 9. American conference on crystal growth: crystal growth, characterization and applications, Baltimore, MD (United States), 1-6 Aug 1993). Order Number DE94015360. Source: OSTI; NTIS; GPO Dep.

Large samples of Ru_2Ge_3 were grown from Ge-rich off-stoichiometric melts at a temperature close to 1,460 C by a vertical gradient freeze method in graphite and glassy carbon crucibles. Diffusionless transition from high temperature tetragonal structure to low temperature orthorhombic structure causes twinning and crack formation. Thermal expansion coefficients of both low and high temperature phases were measured. Some electrical transport properties in the 25–1,000 C temperature range in different crystallographic directions are also described for this high temperature semiconductor. Substantial anisotropy is observed.

27950 (KCP–613-5433) **Elimination of internal contamination on semiconductor devices (protective coatings): Final report.** Castillo, T. Allied-Signal Aerospace Co., Kansas City, MO (United States). Kansas City Div. Jul 1994. 15p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00613. Order Number DE94015868. Source: OSTI; NTIS; GPO Dep.

Characterization results are described of epoxy and gel coatings that were applied to leadless chip carriers (LCC) and TO-46 semiconductor packages. Samples included silicon dioxide, liquid epoxy, epoxy, RTV silicon, and silicon gel; and a standard test sequence was followed. Test results and coating application feasibility for semiconductor packages and military applications are discussed.

27951 (LBL–34810) **Photoluminescence spectroscopy and Rutherford backscattering channeling evaluation of various capping techniques for rapid thermal annealing of ion-implanted ZnSe.** Allen, E.L. (San Jose State Univ., CA (United States). Dept. of Materials Engineering); Zach, F.X.; Yu, K.M.; Bourret, E.D. Lawrence Berkeley Lab., CA (United States). May 1994. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00098. (CONF-940411–48: Spring meeting of the Materials Research Society, San Francisco, CA (United States), 4-8 Apr 1994). Order Number DE94016876. Source: OSTI; NTIS; GPO Dep.

We report on the effectiveness of proximity caps and PECVD Si_3N_4caps during annealing of implanted ZnSe films. OMVPE ZnSe films were grown using diisopropylselenide (DIPSe) and diethylzinc (DEZn) precursors, then ion-implanted with 1×10^{14} cm^{-2} N (33 keV) or Ne (45 keV) at room temperature and liquid nitrogen temperature, and rapid thermal annealed at temperatures between 200C and 850C. Rutherford backscattering spectrometry in the channeling orientation was used to investigate damage recovery, and photoluminescence spectroscopy was used to investigate crystal quality and the formation of point defects. Low temperature implants were found to have better luminescence properties than room temperature implants, and results show that annealing, time and temperature may be more important than capping material in determining the optical properties. Effects of various caps, implant and annealing temperature are discussed in terms of photoluminescence spectra.

27952 (LBL–35626) **AEM and HREM evaluation of carbon nanostructures in silica aerogels.** Song, X.Y.; Cao, W.; Hunt, A.J. Lawrence Berkeley Lab., CA (United States). Apr 1994. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00098. (CONF-940411–41: Spring meeting of the Materials Research Society, San Francisco, CA (United States), 4-8 Apr 1994). Order Number DE94014913. Source: OSTI; NTIS; GPO Dep.

Nanostructured carbon has been deposited in silica aerogels by chemical vapor infiltration using acetylene or ferrocene at moderate temperatures. Using analytical electron microscopy and high-resolution electron microscopy, we have observed various carbon rings and nanotubes in the silica aerogel-based carbon composite. Both X-ray microanalysis and nano-probe diffraction techniques have been used to confirm the presence of those carbon nanostructures. Morphologies and structural properties of the carbon nanotubes and rings have also been examined in detail.

27953 (SAND–93-2758C) **Materials issues in molecular beam epitaxy.** Tsao, J.Y. Sandia National Labs., Albuquerque, NM (United States). [1993]. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. (CONF-940411–46: Spring meeting of the Materials Research Society, San Francisco, CA (United States), 4-8 Apr 1994). Order Number DE94015796. Source: OSTI; NTIS; GPO Dep.

The technology of crystal growth has advanced enormously during the past two decades; among those advances, the development and refinement of molecular beam epitaxy (MBE) has been among the most important. Crystals grown by MBE are more precisely controlled than those grown by any other method, and today form the basis for many of the most advanced device structures in solid-state physics, electronics and optoelectronics. In addition to its numerous device applications, MBE is also an enormously rich and interesting area of materials science in and of itself. This paper, discusses a few examples of some of these materials issues, organized according to whether they involve bulk, thin films, or surfaces.

27954 (SAND–94-0506C) **Microstructures of $InAs_{1-x}Sb_x$ (x = 0.07–0.14) alloys and strained-layer superlattices.** Follstaedt, D.M.; Biefeld, R.M.; Kurtz, S.R., Baucom, K.C. Sandia National Labs., Albuquerque, NM (United States). [1994]. 17p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. (CONF-940616–1: Electronic materials conference, Boulder, CO (United States), 22-24 Jun 1994). Order Number DE94015801. Source: OSTI; NTIS; GPO Dep.

Growth of $InAs_{1-x}Sb_x$ alloys by MOCVD at 475C results in CuPt ordering even at Sb concentrations as low as x = 0.07–0.14. The two $\{111\}_B$ variants are present, but each exists separately in 1–2 μm regions. However, the ordering is incomplete: it occurs in platelet domains lying on {111} habit planes within a disordered matrix, and is not continuous at the atomic scale within the domains. This ordering apparently explains the reduction in infrared emission energies relative to the bandgaps of bulk alloys. Similar ordering is found in an $InAs_{0.91}Sb_{0.09}/In_{0.87}Ga_{0.13}AS$ strained-layer superlattice with lower-than, expected emission energy. High-resolution images indicate that the SLS has planar, sharply defined interfaces. Infrared LEDs have been made from such superlattices.

27955 (SAND–94-1309C) **Determination of the shear modulus in self-assembled monolayers using quartz resonators.** Schneider, T.W.; Martin, S.J.; Frye, G.C. Sandia National Labs., Albuquerque, NM (United States). [1994]. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. (CONF-941063–4: 186. meeting of the Electrochemical Society, Miami, FL (United States), 9-14 Oct 1994). Order Number DE94013449. Source: OSTI; NTIS; GPO Dep.

This work examined self-assembled monolayers (SAMs) of n-alkane thiols using quartz resonators to determine the shear storage and loss moduli. Network analyzer measurements of electrical admittance at fundamental and corresponding harmonic values are fit to an equivalent circuit model. Shear modulus depends on frequency; the modulus values are three orders of magnitude lower than expected for a liquid or elastomeric polymer, more like those of a dense gas or supercritical fluid. A density of around 0.45 g/cm^3 is calculated for a dodecane thiol SAM; this is roughly half of the bulk density. In conclusion, quartz resonators can be used to inertially deform SAMs.

27956 (SAND–94-1644C) **Numerical solution of two-dimensional ablation problems using the finite control volume method with unstructured grids.** Hogan, R.E.; Blackwell, B.F.; Cochran, R.J. Sandia National Labs., Albuquerque, NM (United States). [1994]. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. (AIAA–94-2085; CONF-940625–8: 6. AIAA/ASME thermophysics and heat transfer conference, Colorado Springs, CO (United States), 20-23 Jun 1994). Order Number DE94015012. Source: OSTI; NTIS; GPO Dep.

This paper presents the solution of two-dimensional axisymmetric ablation problems with unstructured grids. The energy equation is formulated and solved using the Finite Control Volume Method. The exterior shape of the ablating body is determined from a surface energy balance with the interior mesh displaced in response to the surface ablation as if the body was a linear elastic solid. Boundary condition matrices are formulated for both heat of ablation and generalized thermochemical ablation boundary conditions. Computed recession rates are compared to an analytical solution to demonstrate the accuracy and convergence of this approach. Additionally, the practical application of this approach to the ablation of a reentry vehicle nose tip is presented.

27957 (SAND–94-1726C) **Reliability implications of defects in high temperature annealed $Si/SiO_2/Si$ structures.** Warren, W.L. (Sandia National Labs., Albuquerque, NM (United States)); Fleetwood, D.M.; Shaneyfelt, M.R.; Winokur, P.S.; Devine, R.A.B.; Mathiot, D.; Wilson, I.H.; Xu, J.B. Sandia National Labs., Albuquerque, NM (United States). [1994]. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. (CONF-940411–44: Spring meeting of the Materials Research Society, San Francisco, CA (United States), 4-8 Apr 1994). Order Number DE94015765. Source: OSTI; NTIS; INIS; GPO Dep.

High-temperature post-oxidation annealing of poly-$Si/SiO_2/Si$ structures such as metal-oxide-semiconductor capacitors and metal-oxide-semiconductor field effect transistors is known to result in enhanced radiation sensitivity, increased 1/f noise, and low field breakdown. The authors have studied the origins of these effects from a spectroscopic standpoint using electron paramagnetic resonance (EPR) and atomic force microscopy. One result of high temperature annealing is the generation of three types of paramagnetic defect centers, two of which are associated with the oxide close to the Si/SiO_2 interface (oxygen-vacancy centers) and the third with the bulk Si substrate (oxygen-related donors). In all three cases, the origin of the defects may be attributed to out-diffusion of O from the SiO_2 network into the Si substrate with associated reduction of the oxide. The authors present a straightforward model for the interfacial region which assumes the driving force for O out-diffusion is the chemical potential difference of the O in the two phases (SiO_2 and the Si substrate). Experimental evidence is provided to show that enhanced hole trapping and interface-trap and border-trap generation in irradiated high-temperature annealed $Si/SiO_2/Si$ systems are all related either directly, or indirectly, to the presence of oxygen vacancies.

27958 (UCRL-ID–117435) **Computer modeling of organic aerogels: Final report of 93-SR-062.** Chandler, E.A.; Calef, D.; Ladd, A.J.C. Lawrence Livermore National Lab., CA (United States). 10 Jun 1994. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. Order Number DE94016485. Source: OSTI; NTIS; GPO Dep.

Goal of the work was to develop computer models of organic aerogel structures, and to study transport process within these materials. During the course of the research understanding of the structure of all aerogels including acid and neutral-catalyzed silica aerogel was developed. The modeling of transport focused on fluid flow in aerogels. We successfully modified a novel state-of-the-art lattice Boltzmann code to simulate flow at low Knudsen number, and developed a simple molecular dynamics code for gas flow at extremely high Knudsen number (low density). These flow-modeling techniques can be used to study aerogel applications for technology transfer; in addition, these techniques can be used to study flow through other porous materials.

27959 (UCRL-JC–116416) **Stress-induced transverse isotropy in rocks.** Schwartz, L.M. (Schlumberger-Doll Research Center, Ridgefield, CT (United States)); Murphy, W.F. III; Berryman, J.G. Lawrence Livermore National Lab., CA (United States). 28 Mar 1994. 13p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-941015–1: Annual meeting of the Society of Exploration Geophysicists, Los Angeles,

CA (United States), 23-27 Oct 1994). Order Number DE94013233. Source: OSTI; NTIS; GPO Dep.

The application of uniaxial pressure can induce elastic anisotropy in otherwise isotropic rock. We consider models based on two very different rock classes, granites and weakly consolidated granular systems. We show that these models share common underlying assumptions, that they lead to similar qualitative behavior, and that both provide a microscopic basis for elliptical anisotropy. In the granular case, we make experimentally verifiable predictions regarding the horizontally propagating modes based on the measured behavior of the vertical modes.

27960 (UCRL-JC–116440) **Numerical simulations of creep in ductile-phase toughened intermetallic matrix composites.** Henshall, G.A.; Strum, M.J. Lawrence Livermore National Lab., CA (United States). 7 Apr 1994. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-9404182–1: 3. intermetallic matrix composites, San Francisco, CA (United States), 4-6 Apr 1994). Order Number DE94014744. Source: OSTI; NTIS; GPO Dep.

Analytical and finite element method (FEM) simulations of creep in idealized ductile-phase toughened intermetallic composites are described. For these strong-matrix materials, the two types of analyses predict similar time-independent composite creep rates if each phase individually exhibits only steady-state creep. The composite creep rate becomes increasingly higher than that of the monolithic intermetallic as the stress exponent of the intermetallic and the volume fraction and creep rate of the ductile phase increase. FEM analysis shows that the shape of the ductile phase does not affect the creep rate but may affect the internal stress and strain distributions, and thus damage accumulation rates. If primary creep occurs in one or both of the individual phases, the composite also exhibits primary creep. In this case, there can be significant deviations in the creep curves computed by the analytical and FEM models. The model predictions are compared with data for the Nb5Si3/Nb system.

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27961 (ANL/CHM/PP–79348) **Diphosphonic acid complexants for improved separation efficiency of transuranic elements.** Nash, K.L. Argonne National Lab., IL (United States). [1994]. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. Order Number DE94016887. Source: OSTI; NTIS; INIS; GPO Dep.

A study was made of the thermodynamics of protonation and complexation of Eu(III), Th(IV), and U(VI) by a series of simple diphosphonic acid chelating agents to assess the potential for application in actinide waste processing. It was found that the strongest complexes are formed with ligands having two phosphonate binding groups on the same C atom (1,1-diphosphonates) and that the water-soluble complexes are formed with protonated ligand species. More efficient separation/recovery processes could be designed using these ligands.

27962 (CEA-R–5644) **Conformational analysis of amide extractants by NMR in organic phase.** Berthon, C. CEA Centre d'Etudes de la Vallee du Rhone, 30 - Marcoule (France). Dept. des Procedes de Retraitement. Aug 1993. 209p. (In French). Order Number DE94631529. Source: OSTI; NTIS (US Sales Only); INIS.

This study deals with nuclear fuel reprocessing. We have essentially used NMR spectroscopy. We want to understand which kind of conformational parameters control selectivity and efficiency of amide extractant. The symmetric monoamides used are DOBA (C_3H_7 CON (CH_2 $CH(C_2H_5)$ $C_4H_9)_2$), DOiBA ($(CH_3)_2$ CCHON ($CH_2CH(C_2H_5)C_4H_9)_2$) and DOTA ($(CH_3)_3$ $CCH_2CON(CH_2CH(C_2H_5)C_4H_9)_2$). Each gives two quasi equivalent conformers (cis and trans) in organic phases. The selected malonamide DMDBTDMA ($(C_4H_9$ $(CH_3)NCO)_2$ $CHC_{14}H_{29}$) has four conformers because of its twice disymmetric amide functions. Weak interactions between monoamides which yield to dimer formation. The malonamide also gives dimers but forms aggregates too. Nitric acid extraction is due to the competitive formation of six species L, L_2, $L_2(HNO_3)$, $L(HNO_3)$, $L(HNO_3)_2$, $L(HNO_3)_3$ (L: monoamide). Complexation between lanthanides (III) and monoamides yields to the stoichiometries $L_3Ln(NO_3)_3$ and $L_2Ln(NO_3)_3$. Their ratio depend of steric hindrance on the carbonyl and the metal ionic radius. The same thing is observed of Pu^{4+} and Th^{4+} extraction in non acidic media. $L_2An(NO_3)_4$ is the main stoichiometric except for the Th^{4+} - DOBA system where the species $(DOBA)_3$ $Th(NO_3)_4$ appear. Exchange rates between the ligand and the complex are pointed out. The monoamide conformations obtained with lanthanide and plutonium nitrate can explain the difference in extracting power of this molecule between An^{4+} and Ln^{3+}. (author). 162 refs., 87 figs., 44 tabs., 7 annexes.

27963 (CONF-9303281–1) **The solvent absorption-extractive distillation (SAED) process for ethanol recovery from gas/vapor streams.** Dale, M.C. Purdue Univ., Lafayette, IN (United States). [1993]. 14p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-85CE40772. From American Institute of Chemical Engineers (AICHE) conference; Chicago, IL (United States); Mar 1993. Order Number DE94013112. Source: OSTI; NTIS; GPO Dep.

A low energy system for ethanol recovery and dehydration has been developed. This system utilizes a solvent for (1) absorption of ethanol vapors, and then the same solvent for (2) extractive distillation. The ideal solvent for this process would have a high affinity for ethanol, and no affinity for water. Heavy alcohols such as dodecanol, and tridecanol, some phosphorals, and some fatty acids have been determined to meet the desired specifications. These solvents have the effect of making water more volatile than ethanol. Thus, a water stream is taken off initially in the dehydration column, and a near anhydrous ethanol stream is recovered from the ethanol/solvent stripper column. Thus the solvent serves dual uses (1) absorption media, and (2) dehydration media. The SAED process as conceptualized would use a solvent similar to solvents used for direct extractive separation of ethanol from aqueous ethanol solutions.

27964 (DOE/ER/13591–8) **Polymer-based separations: Synthesis and application of polymers for ionic and molecular recognition: Annual performance report, August 1, 1993–July 31, 1994.** Alexandratos, S.D. Tennessee Univ., Knoxville, TN (United States). Apr 1994. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG05-86ER13591. Order Number DE94016427. Source: OSTI; NTIS; GPO Dep.

During this period, focus was on design and synthesis of bifunctional polymers for complexing metal ions from aqueous solutions; this could provide a means for separating radioactive and toxic metal ions from contaminated waste water as well as valuable metals from dilute ore processing streams. The synthesis of bifunctional polymers required a new preparative technique; bifunctional interpenetrating polymer networks (IPN) was an important part of the studies. In the preparation, a pre-formed crosslinked polymer is contacted with a solution of monomers, and a second network was polymerized within the first. Imidazole ligands were used. A new resin, prepared with a macrocyclic sorbed within polystyrene beads modified with sulfonic acid ligands, extracted Cu(II) 10–100-fold. Maximum metal ion complexation rates depend on a balance between chemical interactions and physical parameters (matrix porosity, rigidity). A novel ion exchange resin (Diphonix™) has been produced which displays both ionic selectivity (diphosphonic acid ligands) and rapid complexation rates (sulfonic acid ligands).

27965 (DOE/ER/14252–1) **UV laser-surface interactions relevant to analytic spectroscopy of wide bandgap materials.** Dickinson, J.T. Washington State Univ., Pullman, WA (United States). Dept. of Physics. [1993]. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG06-92ER14252. Order Number DE94016180. Source: OSTI; NTIS; GPO Dep.

Laer ablation has application in materials analysis, surface modification, and thin film deposition. Processes that lead to emission

and formation of particles when wide band gap materials are irradiated with pulsed uv laser light. These materials are often difficult to transport into the gas phase for analysis. Such materials are alkali halides, MgO.

27966 (DOE/ER/14252–2) **UV laser-surface interactions relevant to analytic spectroscopy of wide band gap materials.** Dickinson, J.T. Washington State Univ., Pullman, WA (United States). Dept. of Physics. [1994]. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG06-92ER14252. Order Number DE94016181. Source: OSTI; NTIS; GPO Dep.

Laser ablation has application in materials analysis, particularly for refractory materials and for fast screening environmental analysis. Wide bandgap materials are often difficult to transport into the gas phase. Our work was concentrated on desorption and ablation of material from nominally transparent, wide bandgap materials by uv excimer radiation at modest fluences which depends on strongly absorbing lattice defects. The materials were MgO, $NaNO_3$.

27967 (EGG-NRE–11236) **Application of PINS and GNAT to the assay of 55-gal containers of radioactive waste.** Gehrke, R.J.; Aryaeinejad, R.; Watts, K.D.; Staples, D.R.; Akers, D.W. EG and G Idaho, Inc., Idaho Falls, ID (United States). Mar 1994. 43p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE94015319. Source: OSTI; NTIS; INIS; GPO Dep.

The Portable Isotropic Neutron Spectroscopy (PINS) and Gamma Neutron Assay Technique (GNAT) assay systems that were developed with funding from the office of Research and Development (NN20), were taken to the Stored Waste Examination Pilot Plant (SWEPP) facility at the Radioactive Waste Management Complex (RWMC) and applied to the assay of surrogate and Rocky Flats Plant waste contained in 55-gal drums. PINS, a portable prompt γ neutron activation analysis technique, was able to identify key elements in both the surrogate and real waste so that three-main waste categories: metal, combustible material, and cemented chlorinated sludge wastes could be identified. GNAT, a γ, neutron assay technique for the identification and quantification of fissioning isotopes, was able to identify ^{240}Pu in surrogate waste in which nine 1-g nuclear accident dosimeters were inserted. GNAT was also able to identify ^{240}Pu in real 55-gal waste drums containing 15- and 40-g of plutonium even in the presence of high activity concentrations of ^{241}Am.

27968 (HW–67841) **Analysis of E-N loadings.** Zimmer, W.H. Battelle, Columbus, OH (United States). 28 Dec 1960. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE94016272. Source: OSTI; NTIS; GPO Dep.

Three E-N loaded tubes were dissolved, sampled and analyzed, starting November 9, 1960. The results of these analyses and an explanation of the methods used are the subject of this report. Each tube loading received an identification code in each facility in which it was processed. All of these codes are listed for future reference. Each batch of slugs was dissolved in a preflushed dissolver. When complete solution was indicated by a leveling off of the specific gravity, two 1 ml samples were taken and analyzed for uranium, specific gravity, and excess nitric acid. The dissolver charge was digested an additional four hours. At the end of the digestion period, two 1 ml samples and one 20 ml pig sample were taken. The three samples were analyzed for U, SpG, and HNO_3. Agreement between these samples and the previous samples was taken as confirmation of complete dissolution and representative sampling. If agreement was not obtained, sampling was continued. After verification of the pig sample, six 1 ml aliquots were taken for analysis by the Analytical Control group. The remainder was aliquoted to provide material for mass analysis and for analysis by the Process Chemistry group.

27969 (INIS-RU–377, pp. 143) **Elemental concentration depth profiling for multi-element targets on the basis of RBS measurements.** Egorov, V.K.; Okhulkov, A.V. AN SSSR, Moscow (Russian Federation); Moskovskij Gosudarstvennyj Univ., Moscow (Russian Federation). Nauchno-Issledovatel'skij Inst. Yadernoj Fiziki. 1993. 148p. (In Russian). (CONF-9305364–: 23. International meeting on the physics of charged particle interaction with crystals, Moscow (Russian Federation), 31 May - 2 jun 1993). In *Thesises of the proceedings of the 23. International meeting on the physics of charged particle interaction with crystals.* Order Number DE94631501. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. 2 refs., 3 figs. COPPER OXIDES/ion scattering analysis; LANTHANUM OXIDES/ion scattering analysis; ACCURACY; BACKSCATTERING; DEPTH; MONOCRYSTALS; MULTI-ELEMENT ANALYSIS; QUANTITATIVE CHEMICAL ANALYSIS; RUTHERFORD SCATTERING; SPATIAL DISTRIBUTION

27970 (JAERI-M–93-228, pp. 826-833) **Reactor neutron-induced prompt gamma-ray analysis and instrumental neutron activation analysis of ancient glassware.** Tomizawa, T. (Keio Univ., Tokyo (Japan). Faculty of Literature); Yonezawa, C.; Minai, Y.; Hoshi, M.; Ito, Y.; Tominaga, T. Japan Atomic Energy Research Inst., Tokyo (Japan). Nov 1993. (CONF-9303258–: 5. international symposium on advanced nuclear energy research, Mito (Japan), 10-12 Mar 1993; JAERI-CONF–2). In *Proceedings of the fifth international symposium on advanced nuclear energy research: Neutrons as microscopic probes.* 1101p. Order Number DE94748692. Source: OSTI; NTIS; INIS.

Elemental composition of ancient glassware provides a clue to estimate provenance, source material, and manufacturing procedures. In determination of their compositions it is usually desirable to apply nondestructive analytical techniques because even the shape of artifacts should be preserved as excavated for future studies. Reactor neutron-induced prompt gamma-ray analysis (PGA), instrumental neutron activation analysis (INAA), and X-ray fluorescence analysis (XRF) are simultaneous multielement analytical methods providing information on elemental composition. Beside, both techniques are nondestructive method, which are appropriate for studies of such artifacts. In this work we have reported the elemental composition of ancient glassware (from the Yayoi period to the Edo period) excavated from the ruins in Japan to estimate provenance, source material, and manufacturing procedures. (author).

27971 (JAERI-M–93-228, pp. 841-845) **The cadmium content in bone of osteoporotic patients.** Terai, M. (Otsuma Women's Univ., Tokyo (Japan)); Iizuka, K.; Eguchi, M. Japan Atomic Energy Research Inst., Tokyo (Japan). Nov 1993. (CONF-9303258–: 5. international symposium on advanced nuclear energy research, Mito (Japan), 10-12 Mar 1993; JAERI-CONF–2). In *Proceedings of the fifth international symposium on advanced nuclear energy research: Neutrons as microscopic probes.* 1101p. Order Number DE94748692. Source: OSTI; NTIS; INIS.

There are about 50 elements in the human body. A half of them is the essential elements in the organism. The residual elements except main constituents are called the essential trace elements for the organism. Trace elements in human body are very important for physical reactions of life. There is an osteoporosis that is one of the old person's disease. The osteoporosis happened by changing some physical nature of bone with aging. Or hormone imbalance and deficiency of calcium intake degenerated the bone in quality, too. The trace elements in human organ tissues and human bone tissues were determined to make clear distribution of trace elements in the human body by neutron activation analysis. Very much cadmium was found in human bones of osteoporotic patients. Why the high concentration of cadmium present in the bone tissues? Cadmium accumulates in it for long term of years. The Cd rich bone easily damaged by very weak impact. The normal bone mainly formed by Ca-hydroxyapatite with some connective protein tissues. Cadmium containing one formed by the hydroxyapatite, too. There is no apparent change in the nature and crystalline change. (author).

27972 (LA–12765) **Spectrophotometric determination of plutonium-239 based on the spectrum of plutonium(III) chloride.** Temer, D.J.; Walker, L.F. Los Alamos National Lab., NM (United States). Jul 1994. 13p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. Order Number DE94015172. Source: OSTI; NTIS; INIS; GPO Dep.

This report describes a spectrophotometric method for determining plutonium-239 (Pu-239) based on the spectrum of Pu(III) chloride. The authors used the sealed-reflux technique for the dissolution of plutonium oxide with hydrochloric acid (HCl) and small

amounts of nitric and hydrofluoric acids. To complex the fluoride, they added zirconium, and to reduce plutonium to Pu(III), they added ascorbic acid. They then adjusted the solution to a concentration of 2 M HCl and measured the absorbances at five wavelengths of the Pu(III) chloride spectrum. This spectrophotometric determination can also be applied to samples of plutonium metal dissolved in HCl.

27973 (LA-SUB–94-106) **An investigation of the applicability of the new ion exchange resin, Reillex™-HPQ, in ATW separations: Milestone 4, Final report.** Ashley, K.R.; Ball, J.; Grissom, M.; Williamson, M.; Cobb, S.; Young, D.; Wu, Yen-Yuan J. East Texas State Univ., Commerce, TX (United States). 7 Sep 1993. 156p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. Order Number DE94016576. Source: OSTI; NTIS; GPO Dep.

The investigations with the anion exchange resin Reillex™-HPQ is continuing along several different paths. The topics of current investigations that are reported here are: The sorption behavior of chromium(VI) on Reillex™-HPQ from nitric acid solutions and from sodium hydroxide/sodium nitrate solutions; sorption behavior of F^- on Reillex™-HPQ resin in acidic sodium nitrate solution; sorption behavior of Cl^- on Reillex™-HPQ resin in acidic sodium nitrate solution; sorption behavior of Br^- on Reillex™-HPQ resin in acidic sodium nitrate solution; and the Honors thesis by one of the students is attached as Appendix II (on ion exchange properties of a new macroperous resin using bromide as the model ion in aqueous nitrate solutions).

27974 (LA-UR–94-2477) **Performance of an advanced lump correction algorithm for gamma-ray assays of plutonium.** Prettyman, T.H.; Sprinkle, J.K. Jr.; Sheppard, G.A. Los Alamos National Lab., NM (United States). [1994]. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-940748–65: Institute of Nuclear Materials Management annual meeting, Naples, FL (United States), 17-20 Jul 1994). Order Number DE94016195. Source: OSTI; NTIS; INIS; GPO Dep.

The results of an experimental study to evaluate the performance of an advanced lump correction algorithm for gamma-ray assays of plutonium is presented. The algorithm is applied to correct segmented gamma scanner (SGS) and tomographic gamma scanner (TGS) assays of plutonium samples in 55-gal. drums containing heterogeneous matrices. The relative ability of the SGS and TGS to separate matrix and lump effects is examined, and a technique to detect gross heterogeneity in SGS assays is presented.

27975 (LBL–35715) **GAMQUEST, A computer program to identify gamma rays.** Brown, E. Lawrence Berkeley Lab., CA (United States). May 1994. 17p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00098. Order Number DE94016217. Source: OSTI; NTIS; GPO Dep.

This paper describes the application of the computer program GAMQUEST to the study of gamma-ray spectra. The program is especially suited to the analysis of samples produced by neutron activation, and of environmental samples containing radioactive pollutants. GAMQUEST searches a large database (with data for over 60,000 gamma rays) to identify the various spectral lines from samples. The program runs on the VAX/6610 computer cluster of the Lawrence Berkeley Laboratory, and can be accessed from individual accounts or through Hepnet, Internet, or World Wide Web networks.

27976 (OAEP–1-126) **A determination of nitrogen content in rice by fast neutron activation.** Kornduangkaeo, A. Office of Atomic Energy for Peace, Bangkok (Thailand). Dec 1986. 38p. (In Thai). Order Number DE94631502. Source: OSTI; NTIS (US Sales Only); INIS.

The nitrogen contents in rice were determined by using fast neutron activation analysis with a flux of 8.75×10^{10} n/cm^2-sec. The nuclear reaction of interest is ^{14}N (n,2n) ^{13}N. The activity of annihilation radiation of 0.511 MeV from ^{13}N was measured with a semiconductor detector, HPGe (GMX) attached to a multichannel analyzer. Ammonium nitrate was used as standard for the analyses. Correction for the interfering activities originated from nuclear reaction of elements commonly found in such as potassium and phosphorus including recoil protons, were done. Results of analyses for 6 varieties of unpolished rice, that were collected from Bangkhen Testing Paddy Field revealed the nitrogen content of 1.30 to 3.50% which equivalent to the protein content of 8 to 21%.

27977 (OAEP–1-127) **Determination of cerium and lanthanum in nodular cast iron by neutron activation method using GMX detector.** Tungpitayakul, P. Office of Atomic Energy for Peace, Bangkok (Thailand). Dec 1986. 17p. (In Thai). Order Number DE94631503. Source: OSTI; NTIS (US Sales Only); INIS.

Quantitative method for cerium and lanthanum in nodular cast iron has been developed by using non-destructive neutron activation technique. About 100mg of sample was irradiated with thermal neutron flux 3×10^{11} n.cm^{-2}.sec^{-1} for 15 hours. After cooling for 5 days, the photopeak of La-140 at 1.59 MeV was used for determination of lanthanum. Cerium can be determined by using the 0.145 MeV gamma-ray of Ce-141 with GMX detector coupled to a multichannel analyzer of energy per channel of 111 eV. The accuracy of 5% has been obtained by analyzing NBS reference standard.

27978 (OAEP–1-134) **Determination of chromium in laterite.** Tantisatyaraks, W. Office of Atomic Energy for Peace, Bangkok (Thailand). Sep 1987. 11p. (In Thai). Order Number DE94631504. Source: OSTI; NTIS (US Sales Only); INIS.

Quantitative analysis of chromium in laterite of 149 samples from Department of Mineral Resources had been determined by method of Instrumental Neutron Activation Analysis (INAA) in the Thai Research Reactor TTR-1/M1. The parameters which appropriated for analysis are decay time and photopeak. The content of chromium varies from 22 to 838 ppm. Results can be used as indices for chromites exploration.

27979 (OAEP–1-141) **Determination of gallium, scandium, and iron in laterite.** Tantisatyaraks, W. Office of Atomic Energy for Peace, Bangkok (Thailand). Jan 1994. 18p. (In Thai). Order Number DE94631505. Source: OSTI; NTIS (US Sales Only); INIS.

Quantitative analyses of gallium, scandium and iron in laterite of 149 samples were determined by method of Instrumental Neutron Activation Analysis (INAA). The experiments were taken at the Rotary Specimen Racks of the Thai Research Reactor TRR-1/M1. The studied parameters for quantitative analysis are: time of neutron irradiation, decay time, time of measurement and photopeak. The result shows the range of contents as following: 9 ppm to 73 ppm for gallium, 7 ppm to 316 ppm for scandium and 3.37% to 36.80% for iron.

27980 (OAEP–91) **A preliminary study of trace toxic elements in various species of rice in Thailand by neutron activation technique.** Mongkolphantha, S. (Office of Atomic Energy for Peace, Bangkok (Thailand)); Leelhaphunt, N.; Yamkate, P.; Nouchpramool, S.; Rajatatibodee, V.; Karasuddhi, P.; Pookamana, P.; Kongseree, N. Office of Atomic Energy for Peace, Bangkok (Thailand). 1979. 37p. (In Thai). Order Number DE94631500. Source: OSTI; NTIS (US Sales Only); INIS.

Neutron activation analysis, both instrumentally and radiochemically, have been extensively used in a preliminary investigation of arsenic, cadmium, mercury, bromine, cobalt and zinc in 23 varieties of brown and milled glutinous and non-glutinous rice collected from 21 different rice experiment stations throughout the Kingdom. After neutron irradiation, the elements bromine, cobalt and zinc are determined instrumentally while arsenic, mercury and cadmium are determined radiochemically using distillation and precipitation technique for arsenic and mercury and solvent extraction technique for the latter. The limit of detection under the conditions used for arsenic, cadmium, mercury, bromine, cobalt and zinc are 0.001, 0.005, 0.0001, 0.01, 0.01 and 0.01 microgram respectively. The concentration of determined elements in the brown rice is found to be higher than that in the milled rice from both glutinous and non-glutinous rice. Since the baseline level and the maximum permissible level of the determined elements in rice are not yet established in Thailand at present and the quantity of samples employed in this study is not large enough, so the result cannot be regarded as conclusive. However, the Office of Atomic Energy for Peace has formulated, jointly with the Department of Agriculture, a coordinated programme to investigate the baseline level of elements in rice.

27981 (ORNL/TM–12776) **Multidetector calibration for mass spectrometers.** Bayne, C.K. (Oak Ridge National Lab., TN (United States)); Donohue, D.L.; Fiedler, R. Oak Ridge National Lab., TN (United States). Jun 1994. 27p. Sponsored by International Atomic Energy Agency, Vienna (Austria). DOE Contract AC05-84OR21400. (ISPO–367). Order Number DE94017070. Source: OSTI; NTIS; INIS; GPO Dep.

The International Atomic Energy Agency's Safeguards Analytical Laboratory has performed calibration experiments to measure the different efficiencies among multi-Faraday detectors for a Finnigan-MAT 261 mass spectrometer. Two types of calibration experiments were performed: (1) peak-shift experiments and (2) peak-jump experiments. For peak-shift experiments, the ion intensities were measured for all isotopes of an element in different Faraday detectors. Repeated measurements were made by shifting the isotopes to various Faraday detectors. Two different peak-shifting schemes were used to measure plutonium (UK Pu5/92138) samples. For peak-jump experiments, ion intensities were measured in a reference Faraday detector for a single isotope and compared with those measured in the other Faraday detectors. Repeated measurements were made by switching back-and-forth between the reference Faraday detector and a selected Faraday detector. This switching procedure is repeated for all Faraday detectors. Peak-jump experiments were performed with replicate measurements of ^{239}Pu, ^{187}Re, and ^{238}U. Detector efficiency factors were estimated for both peak-jump and peak-shift experiments using a flexible calibration model to statistically analyze both types of multidetector calibration experiments. Calculated detector efficiency factors were shown to depend on both the material analyzed and the experimental conditions. A single detector efficiency factor is not recommended for each detector that would be used to correct routine sample analyses. An alternative three-run peak-shift sample analysis should be considered. A statistical analysis of the data from this peak-shift experiment can adjust the isotopic ratio estimates for detector differences due to each sample analysis.

27982 **Analysis of hydrogen isotope mixtures.** Villa-Aleman, E. To Dept. of Energy. 1992. Filed date 21 Aug 1992. U.S. Patent Application 7-933,145. 17p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035. Order Number DE94016122. Source: OSTI; NTIS; INIS; GPO Dep.

Disclosed are an apparatus and a method for determining concentrations of hydrogen isotopes in a sample. Hydrogen in the sample is separated from other elements using a filter selectively permeable to hydrogen. Then the hydrogen is condensed onto a cold finger or cryopump. The cold finger is rotated as pulsed laser energy vaporizes a portion of the condensed hydrogen, forming a packet of molecular hydrogen. The desorbed hydrogen is ionized and admitted into a mass spectrometer for analysis.

27983 **Apparatus for preparing a sample for mass spectrometry.** Villa-Aleman, E. To Dept. of Energy. 1992. Filed date 21 Aug 1992. U.S. Patent Application 7-933,151. 14p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035. Order Number DE94016121. Source: OSTI; NTIS; INIS; GPO Dep.

Disclosed is an apparatus for preparing a sample for analysis by a mass spectrometer system. The apparatus has an entry chamber and an ionization chamber separated by a skimmer. A capacitor having two space-apart electrodes followed by one or more ion-imaging lenses is disposed in the ionization chamber. The chamber is evacuated and the capacitor is charged. A valve injects a sample gas in the form of sample pulses into the entry chamber. The pulse is collimated by the skimmer and enters the ionization chamber. When the sample pulse passes through the gap between the electrodes, it discharges the capacitor and is thereby ionized. The ions are focused by the imaging lenses and enter the mass analyzer, where their mass and charge are analyzed.

27984 (PNL-SA–23945) **Application of conducting polymers to electroanalysis.** Josowicz, M.A. Pacific Northwest Lab., Richland, WA (United States). Apr 1994. 24p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. (CONF-9404190–1: International symposium on electroanalysis, Cardiff (United Kingdom), 6-8 Apr 1994). Order Number DE94015204. Source: OSTI; NTIS; GPO Dep.

Conducting polymers can be used as sensitive layers in chemical microsensors leading to new applications of theses devices. They offer the potential for developing material properties that are critical to the sensor sensitivity, selectivity and fabrication. The advantages and limitations of the use of thin polymer layers in electrochemical sensors are discussed.

27985 (WHC-SD-EN-TI–266) **Data validation report for the 100-KR-4 operable unit first quarter, 1994.** Krug, A.D. Westinghouse Hanford Co., Richland, WA (United States). [1994]. 138p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE94015329. Source: OSTI; NTIS; INIS; GPO Dep.

Samples were obtained from the 100-KR-4 Operable Unit first Quarter 1994 Groundwater Sampling event. The data from the chemical analysis of fifty-eight samples from this sampling event and their related quality assurance samples were reviewed and validated to verify that reported samples results were of sufficient quality to support decisions regarding remedial actions performed at this site. Information fro the sampling event and the information validation processes are presented in this document.

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Refer also to citation(s) 27575, 27944, 27954, 28006, 28380, 28768

27986 (ANL/CHM/CP–83031) **Anomalous temperature dependence of the lattice parameters in $HoPO_4$ and $HoVO_4$: Rare earth quadrupolar effects.** Skanthakumar, S. (Argonne National Lab., IL (United States)); Loong, C.K.; Soderholm, L.; Nipko, J.; Richardson, J.W. Jr.; Abraham, M.M.; Boatner, L.A. Argonne National Lab., IL (United States); Oak Ridge National Lab., TN (United States). [1994]. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38 ; AC05-84OR21400. (CONF-9408111–2: 2. international conference on f-elements, Helsinki (Finland), 1-6 Aug 1994). Order Number DE94015086. Source: OSTI; NTIS; GPO Dep.

The temperature dependence of the lattice parameters in tetragonal $HoPO_4$ and $HoVO_4$ was measured using neutron powder-diffraction techniques. Below about 100K, the lattice parameter a of $HoPO_4$ increases with decreasing temperature while c decreases. In $HoVO_4$, the above behavior is reversed, that is, a decreases with decreasing temperature while c increases. Similar measurements on nonmagnetic $LUP0_4$ and $LuVO_4$ do not show any anomaly. This observation indicates that the unusual temperature dependence of the lattice constants is magnetic in origin. It can be explained in terms of a Ho^{3+} quadrupole interaction with the crystalline lattice. In particular, the calculated electronically-generated quadrupole moment of the Ho^{3+} in $HoPO_4$ and $HoVO_4$ exhibits a temperature dependence similar to that observed in the lattice parameters.

27987 (CONF-940744–5) **Activity of Ga, In and Cu modified MFI zeolites for amine reactions.** Kanazirev, V.; Price, G.L. Louisiana State Univ., Baton Rouge, LA (United States). Dept. of Chemical Engineering. [1994]. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG05-92ER14291. From 10. international zeolite conference; Garmish-Partenkirchen (Germany); 17-22 Jul 1994. Order Number DE94016532. Source: OSTI; NTIS; GPO Dep.

High densities of Ga, In and Cu cations (Me/Al=1) in MFI zeolites have been obtained via thermal treatment of mechanical mixtures of metal oxides with H-MFI resulting in solid state ion-exchange. Ga and In require an H_2 reducing agent during thermal treatment while Cu requires only an absence of O_2 and undergoes autoreduction during thermal treatment. Using both thermal analysis with MS detection and catalytic testing in a gradientless batch recirculating reactor, the modified catalysts have been shown to be highly reactive towards amines. The desorption features of 1-propanamine with cation containing MFI generally differ from those of pure HMFI zeolite. Propanenitrile, C_2-C_6 alkenes and aromatics appear in the decomposition products. Catalytic experiments have revealed that Ga, In, and Cu zeolitic cations promote dehydrogenation and condensation reactions of propanamine to different

extents. Such behavior probably results from Lewis acid interactions of the zeolite cation with the amine.

27988 (DOE/CE/23810–34) **Solubility, viscosity and density of refrigerant/lubricant mixtures: Final technical report, [1 October 1992–19 April 1994].** Henderson, D.R. Spauschus Associates, Inc., Stockbridge, GA (United States). Apr 1994. 144p. Sponsored by USDOE, Washington, DC (United States);Air-Conditioning and Refrigeration Technology Inst., Inc., Arlington, VA (United States). DOE Contract FG02-91CE23810. Order Number DE94016949. Source: OSTI; NTIS; GPO Dep.

This report presents the results of experimental measurements on low refrigerant concentration mixtures (0, 10, 20 and 30 weight percent) and high refrigerant concentration mixtures (80, 90 and 100 weight percent) of chlorofluorocarbon (CFC) 12, hydrochlorofluorocarbons (HCFC's) 22, 123, 124 and 142b, and hydrofluorocarbons (BFC's) 134a, 32, 125, 152a and 143a with mineral oil, alkylbenzene, polyalkylene glycol and polyolester lubricants. Viscosity, solubility (vapor pressure) and density data are reported for thirty five working fluids which are selected combinations of these refrigerants and companion lubricants. These data, reduced to engineering form, are presented in the form of a Daniel Chart and a plot of density versus temperature and composition. Extensive numerical analysis has been performed in order to derive equations which allow two independent variables (temperature and composition) and to provide for corrections in composition due to vapor space volume in the test apparatus.

27989 (DOE/ER/13296–10) **The transformation of organic amines by transition metal cluster compounds: Progress report, 1993–1994.** Adams, R.D. South Carolina Univ., Columbia, SC (United States). Dept. of Chemistry. Jan 1994. 20p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG09-84ER13296. Order Number DE94017151. Source: OSTI; NTIS; GPO Dep.

In the recent year, the authors extended investigations into insertion reactions by investigating the insertion of dicarboxylate acetylene into the metal-metal bond of $Re_2(CO)_9(NCMe)$. Secondly, the authors considered the ring opening reactions of the cyclic thioethers: tetrahydrothiophene and thiacyclohexane when complexed to $Os_3(CO)_{10}(NCMe)_2$. In a third effort, various osmium complexes of cyclobutynes were synthesized and the subsequent reactivity probed. Finally, energy storage (via absorption of UV-visible photons) in osmium cluster compounds was investigated.

27990 (DOE/ER/14103–T1) **Catalysis looks to the future: Panel on new directions in catalytic science and technology.** National Academy of Sciences - National Research Council, Washington, DC (United States). 1992. 93p. Sponsored by USDOE, Washington, DC (United States);National Science Foundation, Washington, DC (United States). DOE Contract FG05-90ER14103. Order Number DE94015309. Source: OSTI; NTIS; GPO Dep.

Catalysts play a vital role in providing society with fuels, commodity and fine chemicals, pharmaceuticals, and means for protecting the environment. To be useful, a good catalyst must have a high turnover frequency (activity), produce the right kind of product (selectivity), and have a long life (durability), all at an acceptable cost. Research in the field of catalysis provides the tools and understanding required to facilitate and accelerate the development of improved catalysts and to open opportunities for the discovery of new catalytic processes. The aim of this report is to identify the research opportunities and challenges for catalysis in the coming decades and to detail the resources necessary to ensure steady progress. Chapter 2 discusses opportunities for developing new catalysts to meet the demands of the chemical and fuel industries, and the increasing role of catalysis in environmental protection. The intellectual challenges for advancing the frontiers of catalytic science are outlined in Chapter 3. The human and institutional resources available in the US for carrying out research on catalysis are summarized in Chapter 4. The findings and recommendations of the panel for industry, academe, the national laboratories, and the federal government are presented in Chapter 5.

27991 (DOE/ER/14291–T1) **Gallium zeolites for light paraffin aromatization: Progress report, August 15, 1992–February 15, 1994.** Price, G.L.; Dooley, K.M. Louisiana State Univ., Baton Rouge, LA (United States). Dept. of Chemical Engineering. Mar 1994. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG05-92ER14291. Order Number DE94016431. Source: OSTI; NTIS; GPO Dep.

Focus of the research work is to relate the catalytic properties of Ga Zeolites to the preparation method and to unify the various theories about the active nature of Ga Zeolites for light paraffin aromatization. During this reporting period, thermal analysis of alkylamines has been studied extensively and applied with great success to the problem. New features of alkylamine thermal analysis have been discovered and described. Because of the success of this method for the characterization of cation-containing MFI, some spin-off work on Cu-MFI (which currently has broad interest as an NO decomposition catalyst) has been accomplished.

27992 (DOE/ER–30201-H1-Vol.1) **Assessment of research needs for advanced heterogeneous catalysts for energy applications: Final report: Volume 1, Executive summary.** Mills, G.A. Consultec Scientific, Inc., Knoxville, TN (United States). Apr 1994. 28p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-92ER30201. Order Number DE94015889. Source: OSTI; NTIS; GPO Dep.

This report assesses the direction, technical content, and priority of research needs judged to provide the best chance of yielding new and improved heterogeneous catalysts for energy-related applications over a period of 5–20 years. It addresses issues of energy conservation, alternate fuels and feedstocks, and the economics and applications that could alleviate pollution from energy processes. Recommended goals are defined in 3 major, closely linked research thrusts: catalytic science, environmental protection by catalysis, and industrial catalytic applications. This volume provides a comprehensive executive summary, including research recommendations.

27993 (DOE/ER–30201-H1-Vol.2) **Assessment of research needs for advanced heterogeneous catalysts for energy applications: Final report: Volume 2, Topic reports.** Mills, G.A. Consultec Scientific, Inc., Knoxville, TN (United States). Apr 1994. 224p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-92ER30201. Order Number DE94015890. Source: OSTI; NTIS; GPO Dep.

This report assesses the direction, technical content, and priority of research needs judged to provide the best chance of yielding new and improved heterogeneous catalysts for energy-related applications over the period of 5-20 years. It addresses issues of energy conservation, alternate fuels and feedstocks, and the economics and applications that could alleviate pollution from energy processes. Recommended goals are defined in 3 research thrusts: catalytic science, environmental protection by catalysis, and industrial catalytic applications. This study was conducted by an 11-member panel of experts from industry and academia, including one each from Japan and Europe. This volume first presents an in-depth overview of the role of catalysis in future energy technology in chapter 1; then current catalytic research is critically reviewed and research recommended in 8 topic chapters: catalyst preparation (design and synthesis), catalyst characterization (structure/function), catalyst performance testing, reaction kinetics/reactor design, catalysis for industrial chemicals, catalysis for electrical applications (clean fuels, pollution remediation), catalysis for control of exhaust emissions, and catalysts for liquid transportation fuels from petroleum, coal, residual oil, and biomass.

27994 (DPW–56-135) **Thermodynamic values of interest in metallurgy.** Pohl, K.A. Du Pont de Nemours (E.I.) and Co., Wilmington, DE (United States). Explosives Dept. 26 Jan 1956. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-76SR00001. (SR/H–767). Order Number DE94016650. Source: OSTI; NTIS; GPO Dep.

Tables are presented for free energy and heat of formation for salts (oxides, sulfides, halides) metals often encountered in metallurgy.

27995 (FRCEA-TH–415) **Structure and amphoteric properties of titanium dioxide gels.** Kertesz, C. Institut National des Sciences et Techniques Nucleaires (INSTN), Centre d'Etudes de Saclay, 91 - Gif-sur-Yvette (France); Paris-6 Univ., 75 (France). 16

Apr 1991. 251p. (In French). Order Number DE94631537. Source: OSTI; NTIS (US Sales Only); INIS.

Mechanisms responsible for the in-solution ion retention by titanium dioxide are studied. Mineral oxide gel formation and structure are described and various titanium dioxide gel synthesis modes are presented. A two-phase model, taking into account the porous nature of the solid and allowing for the application of the mass action law, is adopted. The oxide amphoteric properties are studied with the potentiometric titration technique. Hysteresis loops are imputed to the slowness of the acid-basic neutralization reaction. The main characteristics are determined: isoelectric point, cation and anion retention capacity. Depending on the suspension agitation, the speed limiting factor may be the diffusion in the film or the diffusion in the particle. 60 fig., 128 ref.

27996 (INIS-mf–15003) **Structure and physico-chemical properties of high-Tc superconductors for use in wires and strips: Final report.** Technische Univ. Dresden (Germany). Sektion 4 - Physik. [1993]. 1p. (In German). Sponsored by Bundesministerium fuer Forschung und Technologie, Bonn (Germany). Foerderkennzeichen BMFT 13N5952. Order Number DE94790576. Source: OSTI; NTIS (US Sales Only); INIS.

Preparatory work for application of the analytical method encompassed methodological experiments and studies relating to the (a) preparation of ceramic specimens (b) optimization of measuring conditions in the temperature range from 10 K to 300 K (c) quantitative and qualitative phase analysis (d) quantitative structural analysis. One particular task was to develop a computer code for the control of automated measurements including a variation of temperature, measurements to be carried out with the D 5000 X-ray diffractometer system of Fa. Siemens which was especially installed for the R and D project. The successful achievement of the R and D tasks in the project laid the basis for performance of the qualitative and quantitative crystallographic phase analyses using X-radiation, to be carried out within the framework of the next research project. (MM)

27997 (LBL–35162) **Preparations and characterizations of novel graphite-like materials and some high oxidation state fluorine chemistry.** Shen, Ciping. Lawrence Berkeley Lab., CA (United States). Nov 1992. 280p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00098. Order Number DE94016869. Source: OSTI; NTIS; GPO Dep.

Novel graphite-like materials, BC_x ($6>x\geq3$), have been prepared using BCl_3 and C_6H_6 at 800–1000C, and C_xN ($14>x\geq5$) have been synthesized using C_5H_5N and Cl_2 at 680C–986C. Bulk and thin film characterization were used to study the structure and bonding in these solids. $C_8K(NH_3)_{1.1}$ was prepared by reacting C_8K with gaseous NH_3. The carbon sub-lattice is hexagonal: a = 2.47 Å, c = 6.47 Å. The smaller a parameter and lower conductivity are attributed to smaller electron transfer from K to the conduction band solvation of K by NH_3. A simplified liquid phase method for synthesizing Li-graphite intercalation compounds has been developed; synthesis of a lamellar mixed conductor, $C_x^+Li_2N^-$, has been attempted. Stability and conductivity of $(BN)_3SO_3F$ have been studied; it was shown to be metallic with a specific conductivity of 1.5 $S{\cdot}cm^{-1}$. Its low conductivity is attributed to the low mobility of holes in BN sheets.

27998 (OAEP–1-128) **The development of analytical method of lead-210 in soil by ion exchange technique.** Potipin, K. (Office of Atomic Energy for Peace, Bangkok (Thailand)); Matthews, K.M. Office of Atomic Energy for Peace, Bangkok (Thailand). Dec 1986. 21p. (In Thai). Order Number DE94631534. Source: OSTI; NTIS (US Sales Only); INIS.

The determination of "extractable Pb-210" and "total Pb-210" in soil has been investigated. The process involved searching for the suitable chemical reagent for extraction of Pb-210 from soil, the improvement of chemical yield and the purification of lead by ion exchange technique. The purified precipitate covered with cello tape was stored to allow ingrowth of Bi-210. The β-radiation of Bi-210 was counted using low levels/β scintillation counter for 800 min. The reliability test of the developed technique was performed using the prepared Pb-210 standard solution. The recovery yield of "extractable Pb-210" and "total Pb-210" by this method were 90-97% and 80% respectively. The optimum condition in extraction of Pb-210 was found to be 0.1 N nitric acid, 250 ml at 90 C for 25 min.

27999 (SAND–94-0219) **Surftherm: A program to analyze thermochemical and kinetic data in gas-phase and surface chemical reaction mechanisms.** Coltrin, M.E.; Moffat, H.K. Sandia National Labs., Albuquerque, NM (United States). Jun 1994. 46p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. Order Number DE94016145. Source: OSTI; NTIS; GPO Dep.

This report documents the Surftherm program that analyzes transport coefficient, thermochemical- and kinetic rate information in complex gas-phase and surface chemical reaction mechanisms. The program is designed for use with the Chemkin (gas-phase chemistry) and Surface Chemkin (heterogeneous chemistry) programs. It was developed as a "chemist's companion" in using the Chemkin packages with complex chemical reaction mechanisms. It presents in tabular form detailed information about the temperature and pressure dependence of chemical reaction rate constants and their reverse rate constants, reaction equilibrium constants, reaction thermochemistry, chemical species thermochemistry and transport properties. This report serves as a user's manual for use of the program, explaining the required input and the output.

4004 Electrochemistry

Refer also to citation(s) 27197

4005 Photochemistry

Refer also to citation(s) 27988

4006 Radiation Chemistry

28000 (INS–1024) **Large-sized and highly radioactive ^3H and ^{109}Cd Langmuir-Blodgett films.** Shibata, S. (and others); Kawakami, H.; Kato, S. Tokyo Univ., Tanashi (Japan). Inst. for Nuclear Study. Feb 1994. 25p. Order Number DE94785270. Source: OSTI; NTIS; INIS.

A device for the deposition of a radioactive Langmuir-Blodgett (LB) film was developed with the use of: (1) a modified horizontal lifting method, (2) an extremely shallow trough, and (3) a surface pressure-generating system without piston oil. It made a precious radioactive subphase solution repeatedly usable while keeping its radioactivity concentration as high as possible. Any large-size thin films can be prepared by just changing the trough size. Two monomolecular-layers of Y-type films of cadmium [^3H] icosanoate and ^{109}Cd icosanoate were built up as ^3H and ^{109}Cd β-sources for electron spectroscopy with intensities of 1.5 GBq (40 mCi) and 7.4 MBq (200 μCi), respectively, and a size of 65x200 mm^2. Excellent uniformity of the distribution of deposited radioactivity was confirmed by autoradiography and photometry. (author).

4007 Radiochemistry and Nuclear Chemistry

Refer also to citation(s) 27685, 27907, 27993, 28530

28001 (BNL–60338) **Use of supercritical carbon dioxide fluid as a solvent for the purification of pet radiotracers.** Ferrieri, R.A.; Fowler, J.S.; Wolf, A.P. Brookhaven National Lab., Upton, NY (United States). [1993]. 14p. Sponsored by USDOE, Washington, DC (United States);Department of Health and Human Services, Washington, DC (United States). DOE Contract AC02-76CH00016. Grant NS-15380. (CONF-9309170–4: 5. international workshop on targetry and target chemistry, Upton, NY (United States), 20-24 Sep 1993). Order Number DE94014083. Source: OSTI; NTIS; GPO Dep.

We have identified superfluid chromatography (SFC) as a promising method which could offer advantages in radiotracer purification through rapid separation, as well as, improved recovery and purity of labeled product. Using SF CO_2 as the mobile phase for chromatographic separation of labeled product would eliminate the need for solvent removal from product prior to delivery.

28002 (HW–75942) **Development test IP-556-D, irradiation service request HAPO-278, outgassing rate of tritium at high temperatures.** DeMers, A.E. Battelle, Columbus, OH (United States). 21 Dec 1962. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE94015970. Source: OSTI; NTIS; GPO Dep.

The test objective is to determine the effect of radiation and temperature on the outgassing rate of tritium generated in a lithium-aluminum alloy by neutron irradiation.

28003 (LA–12811-MS) **Mechanical behavior of $^{238}UO_2$, $^{238}PuO_2$, and $^{239}PuO_2$ as a function of strain rate and temperature.** Stout, M.G.; Ellis, R.W.; Pereyra, R.A. Los Alamos National Lab., NM (United States). Aug 1994. 35p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. Order Number DE94015718. Source: OSTI; NTIS; INIS; GPO Dep.

The mechanical response of $^{238}UO_2$ was measured as a function of strain rate and temperature. We evaluated material produced by two processing schedules: hot pressing followed by a grain stabilization; and cold pressing plus a sintering treatment. The response of these two materials was identical, within the scatter of our data. We complemented our data with that published in the literature, after having made the appropriate corrections for grain size, porosity, and stoichiometry. The entire collection of data was used to evaluate the Follansbee-Kocks mechanical threshold stress (MTS) model for the prediction of yield stress as a function of strain rate and temperature. We used this model to predict the yield stress of $^{238}UO_2$ for strain rates between $\dot{\epsilon} = 10^{-5}$ and 10^{3} s^{-1} and temperatures from 800 to 1600C. These predictions provided the basis for constructing a deformation/fracture map for both urania and plutonia. Examination of the maps indicates that for compressive loading and impact strain rates, the $^{238}UO_2$ will be an excellent mock material for $^{238}PuO_2$. Under these conditions both the strength and deformation and the fracture modes are consistent between these two materials.

28004 (UCRL-ID–115386) **Thermodynamic constants for actinide oxides and oxyhydroxides relevant to actinide volatility calculations for thermal oxidation processes.** Ebbinghaus, B.B.; Krikorian, O.H. Lawrence Livermore National Lab., CA (United States). 27 Oct 1993. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. Order Number DE94007762. Source: OSTI; NTIS; GPO Dep.

The purpose of this report is to provide input of thermodynamic data on actinide volatilities to EERC for use in their computer code for modeling of metal volatilities in incinerators. It is also anticipated that the data may be documented later in an EPA sponsored "Metals Bible." It should be noted that only upper limits for the volatility of PuO_2(s) due to PuO_3(g) and $PuO_2(OH)_2$(g) and the volatility of AmO_2 in PuO_2(s) due to AmO_3(g) and $AmO_2(OH)_2$(g) could be set. The data on the americium vapor species are intended for calculations where AmO_2 is present as a solid solution in PuO_2(s).

28005 (WSRC-TR–93-454) **Solubility of uranium in alkaline salt solutions.** Hobbs, D.T.; Edwards, T.B. Westinghouse Savannah River Co., Aiken, SC (United States). 29 Mar 1994. 51p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035. Order Number DE94015556. Source: OSTI; NTIS; INIS; GPO Dep.

The solubility of uranium in alkaline salt solutions was investigated to screen for significant factors and interactions among the major salt components and temperature. The components included in the study were the sodium salts of hydroxide, nitrate, nitrite, aluminate, sulfate, and carbonate. General findings from the study included: (1) uranium solubilities are very low (1-20 mg/L) for all solution compositions at hydroxide concentrations from 0.1 to 17 molar (2) carbonate, sulfate, and aluminate are not effective complexants for uranium at high hydroxide concentration, (3) uranium solubility decreases with increasing temperature for most alkaline salt solutions, and (4) uranium solubility increases with changes in solution chemistry that reflect aging of high level waste (increase in nitrite and carbonate concentrations, decrease in nitrate and hydroxide concentrations). A predictive model for the concentration of uranium as a function of component concentrations and temperature was fitted to the data. All of the solution components and temperature were found to be significant. There is a significant lack of fit for the model, which suggests that the dependence on the uranium solubility over the wide range of solution compositions is non-linear and/or that there are other uncontrolled parameters which are important to the uranium solubility.

4008 Combustion, Pyrolysis, and High-Temperature Chemistry

Refer also to citation(s) 27998, 28761

28006 (CONF-9405109–6) **Assessing post-fire combustion of polyurethane.** Williams, W.R.; Anderson, J.C. Oak Ridge National Lab., TN (United States). [1994]. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From Department of Energy defense programs packaging workshop; Knoxville, TN (United States); 16-19 May 1994. Order Number DE94011461. Source: OSTI; NTIS; GPO Dep.

In defining hypothetical accident condition thermal test requirements, 10 CFR 71.73(c)(3) states that "any combustion of materials of construction must be allowed to proceed until it terminates naturally." Two examples of extended burning of packages following the regulatory fire are documented. This paper addresses extended burning after cessation of the 30-min, 1475°F regulatory fire from an analytical perspective with specific application to a package containing polyurethane insulation. Issues include identifying conditions under which materials of construction burn, estimating burn rate, and establishing criteria for cessation of burning. These data and criteria are then applied to determine package temperature profiles using a finite element model. Development of the illustrative problem demonstrates a number of difficulties that are faced when using analytical models to simulate hypothetical thermal accident conditions.

28007 (DOE/ER/13439–T4) **Infrared absorption spectroscopy and chemical kinetics of free radicals: Progress report, February 1, 1991–March 1, 1994.** Curl, R.F.; Glass, G.P. Rice Univ., Houston, TX (United States). [1994]. 13p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG05-85ER13439. Order Number DE94016642. Source: OSTI; NTIS; GPO Dep.

Rate of reaction of ketenyl radical with O_2 at room temperature was determined as 6.5(6) x 10^{-13} CM^3 $molecules^{-1}$ s^{-1} and an upper bound of 1×10^{-13} cm^3 $molecule^{-1}$ s^{-1} was estimated for the reaction rate of acetylene with ketenyl. The high resolution spectrum of the $\nu 1$ acetylenic CH stretch of propargy1 radical ($HCCCH_2$) near 3322 cm^{-1} has obtained and analyzed. Nuclear spin weights demonstrate that the CH_2 hydrogen atoms are in the carbon atom plane. We have attempted to measure the propargy1 recombination rate constant at 296 K; however, the observed rate constant of $(1.2 \times 0.2) \times 10^{-10}$ cc-$molecule^{-1}$-s^{-1} may be affected by other reactions. The CH stretch fundamental, $\nu 1$, of HCCN has been observed, assigned, and analyzed. Analysis of the hot bands associated with bending shows that HCCN is a quasilinear molecule with a very floppy potential function for the HCC bending angle. The barrier to linearity is estimated to be about 100 cm^{-1}. Rate of the reaction between C_2H and H_2 has been measured at 295–855 K. The rate constant exhibited a non-Arrhenius form well represented by $k = (9.44 \pm 0.50) \times 10^{-14} T^{0.9} \exp(-1003 \pm 40/T) cm^3 molecule^{-1} s^{-1}$. The reaction between atomic oxygen and the amidogen radical, NH_2 has been studied at 295 K; the room temperature rate constant was measured as $(6.5 \pm 1.3) \times 10^{-1}$ s^{-1}. The minor channel leading to NH + OH was observed but accounted for at most about 8% of the NH_2 reacting. The rate constant for the reaction NH+O was determined from fitting the NH time profile to be $6.6 \pm 10_{-11}$ cm^3 $molecule^{-1}$ s^{-1}.

28008 (LBL–35559) **Experimental study of premixed flames in intense isotropic turbulence.** Bedat, B.; Cheng, R.K. Lawrence Berkeley Lab., CA (United States). Apr 1994. 22p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00098. (CONF-940711–17: 25. international symposium on combustion, Irvine, CA (United States), 31 Jul - 5 aug 1994). Order Number DE94016868. Source: OSTI; NTIS; GPO Dep.

A methodology for investigating premixed turbulent flames propagating in intense isotropic turbulence has been developed. The

burner uses a turbulence generator developed by Videto and Santavicca and the flame is stabilized by weak-swirl generated by air injectors. This set-up produces stable premixed turbulent flames under a wide range of mixture conditions and turbulence intensities. The experiments are designed to investigate systematically the changes in flame structures for conditions which can be classified as wrinkled laminar flames, corrugated flames and flames with distributed reaction zones. Laser Doppler anemometry and Rayleigh scattering techniques are used to determine the turbulence and scalar statistics. In the intense turbulence, the flames are found to produce very little changes in the mean and rams velocities. Their flame speed increase linearly with turbulence intensity as for wrinkled laminar flames. The Rayleigh scattering pdfs for flames within the distributed reaction zone regime are distinctly bimodal. The probabilities of the reacting states (i.e. contributions from within the reaction zone) is not higher than those of wrinkled laminar flame. These results show that there is no drastic changes in flame structures at Karlovitz number close to unity. This suggest that the Klimov-Williams criterion under-predicts the resilience of wrinkled flamelets to intense turbulence.

42 ENGINEERING

28009 (NUREG/CR–6116-Vol.5) **Systems Analysis Programs for Hands-on Integrated Reliability Evaluations (SAPHIRE), Version 5.0: Volume 5, Systems Analysis and Risk Assessment (SARA) tutorial manual.** Sattison, M.B. (EG and G Idaho, Inc., Idaho Falls, ID (United States)); Russell, K.D.; Skinner, N.L. Nuclear Regulatory Commission, Washington, DC (United States). Div. of Safety Issue Resolution; EG and G Idaho, Inc., Idaho Falls, ID (United States). Jul 1994. 109p. Sponsored by Nuclear Regulatory Commission, Washington, DC (United States). DOE Contract AC07-76ID01570. (EGG–2716-Vol.5). Source: OSTI; NTIS; INIS; GPO.

The Systems Analysis Programs for Hands-on Integrated Reliability Evaluations (SAPHIRE) refers to a set of several microcomputer programs that were developed to create and analyze probabilistic risk assessments (PRAs) primarily for nuclear power plants. This volume is the tutorial manual for the Systems Analysis and Risk Assessment (SARA) System Version 5.0, a microcomputer-based system used to analyze the safety issues of a "family" [i.e., a power plant, a manufacturing facility, any facility on which a probabilistic risk assessment (PRA) might be performed]. A series of lessons is provided that guides the user through some basic steps common to most analyses performed with SARA. The example problems presented in the lessons build on one another, and in combination, lead the user through all aspects of SARA sensitivity analysis capabilities.

4202 Facilities, Equipment, and Techniques

Refer also to citation(s) 27279, 27282, 27304, 27306, 27358, 27371, 27397, 27406, 27408, 27411, 27414, 27420, 27431, 27436, 27444, 27446, 27492, 27526, 27790, 28372, 28945

28010 (ANL/OTM/CR–7) **A simplified thermohydrodynamic model for fluid film bearings: Final report, February 15, 1992–February 15, 1994.** Szeri, A.Z. (Pittsburgh Univ., PA (United States). Dept. of Mechanical Engineering). Argonne National Lab., IL (United States). Mar 1994. 78p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. Order Number DE94015011. Source: OSTI; NTIS; GPO Dep.

We aim to develop a simplified yet realistic model of fluid film lubrication under thermohydrodynamic conditions, with significant thermal and elastic deformation of the bearing pads. The principal thrust is transfer of technology from the researcher to the industrial designer: the end product will include two user-friendly computer programs, one for journal bearings and the other for thrust bearings, to be used for bearing design in interactive mode on a personal computer.

28011 (CONF-940684–4) **Turbulent mixing of the HVOF thermal spray and coating oxidation.** Hackett, C.M.; Settles, G.S. Pennsylvania State Univ., University Park, PA (United States). [1994]. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-92ER14302. From 1994 national thermal spray conference; Boston, MA (United States); 20-24 Jun 1994. Order Number DE94015414. Source: OSTI; NTIS; GPO Dep.

An important aspect of the High Velocity Oxy-Fuel (HVOF) thermal spray process is the turbulent mixing of the spray jet with the surrounding atmosphere. Flow visualization reveals large-scale coherent eddies that are responsible for the entrainment and resulting mixing of ambient atmosphere into the jet. This entrainment increases the mass flux of the jet by an order of magnitude at typical spray standoff distances. However, the spray particles in flight remain somewhat isolated from the entrained atmosphere due to the low gas density at the centerline of the jet. Following the impingement of the jet upon the substrate surface being coated, a hot boundary layer containing significant amounts of oxygen envelops the surface. Through the analysis of sprayed aluminum coatings, it appears that the coating oxide content results principally from oxidation after particle impact while the still-hot coating is exposed to this boundary layer. The oxidation of spray particles in flight is a minor source of oxide inclusions in comparison. Thus, the key factor affecting HVOF coating oxidation appears to be thermal management of the substrate being coated.

28012 (DOE/DP–0125) **Operating experience review - Ventilation systems at Department of Energy Facilities.** USDOE Assistant Secretary for Defense Programs, Washington, DC (United States). May 1994. 151p. Sponsored by USDOE, Washington, DC (United States). Order Number DE94016143. Source: OSTI; NTIS; GPO Dep.

The Office of Special Projects (DP-35), formerly Office of Self-Assessment (DP-9), analyzed occurrences caused by problems with equipment and material and recommended the following systems for an in-depth study: (1) Selective Alpha Air Monitor (SAAM), (2) Emergency Diesel Generator, (3) Ventilation System, (4) Fire Alarm System. Further, DP-35 conducted an in-depth review of the problems associated with SAAM and with diesel generators, and made several recommendations. This study focusses on ventilation system. The intent was to determine the causes for the events related to these system that were reported in the Occurrence Reporting and Processing System (ORPS), to identify components that failed, and to provide technical information from the commercial and nuclear industries on the design, operation, maintenance, and surveillance related to the system and its components. From these data, sites can develop a comprehensive program of maintenance management, including surveillance, to avoid similar occurrences, and to be in compliance with the following DOE orders.

28013 (EGG–1183-6) **ETS-1 I&C System cost at completion estimate: Revision B.** EG and G, Inc., Las Vegas, NV (United States). 3 Mar 1964. 21p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC08-76NV01183. Order Number DE94015392. Source: OSTI; NTIS; GPO Dep.

EG&G submits the following estimated cost at completion of the ETS-1 I&C System as represented by the approved, Reduced Design Package, the SNPO-C letter TSB:AL dated 30 January 1964 and the Approved Program Plan. A summary of this cost estimate and of previous cost estimates, is given. The total cost estimate is $5, 284, 000. While some items have individual costs which differ from those shown in SNPO-C letter of 30 January 1964, the total cost is consistent with that letter. Specifically, there is a greater proportion of equipment costs in this estimate than in the funding plan contained in the SNPO-C letter due to new equipment estimates from industry. We discuss the basis for the present cost estimate, and summarize options and leasing plans which will be exercised by the Government. We also discuss Facility Modification design and Miscellaneous Crafts Work, respectively. EG&G has only design responsibility for these latter two items. The cost estimates are best estimates, neither worst cases nor optimistic cases, and do not allow for contingencies. While contingencies have not been included in previous Cost at Completion Estimates, we believe that in the spirit of the second paragraph of SNPO-C letter dated 30 January 1964, contingencies must be acknowledged. EG&G's recommendations in this regard are presented along with mention of two alternate plans which SNPO-C may prefer to employ.

28014 (EGG–1183-1218) **RTOD-photo operations and procedures manual.** EG and G, Inc., Las Vegas, NV (United States). 15 Mar 1966. 87p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC08-76NV01183. Order Number DE94015927. Source: OSTI; NTIS; GPO Dep.

This document presents a survey of the EG&G NRDS photographic operation in four major sections and includes the work scope, procedures, some technical backgrounding and operational information. Two sections, Instrumentation and Photo Systems, include the areas of direct responsibilities while a section on Film Handling and Coordination and a section covering special information, pertinent to the project, are included to adequately complete this survey. The photographic group is housed in two trailers within the control point area at NRDS and from these trailers provides photographic support at a number of locations. Four camera bunkers, three camera towers, a kinescope system, a microfilm system and remote camera controls comprise the facilities that the group maintains and operates outside these trailers. The work load includes major items such as: motion picture coverage of the nuclear rocket engine tests, data record microfilming, kinescope recording, and documentary coverage of the company related operational responsibilities. In addition, a number of minor photographic services are extended, when required. The nature of the work, because of its importance within the research and development efforts at NRDS, requires optimum quality and efficiency throughout. The many procedures outlined here have been designed to satisfy these requirements.

28015 (EGG-WM–11011) **Feasibility study for a DOE research and production fuel multipurpose canister.** Lopez, D.A.; Abbott, D.G. EG and G Idaho, Inc., Idaho Falls, ID (United States). Feb 1994. 53p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE94015254. Source: OSTI; NTIS; INIS; GPO Dep.

This is a report of the feasibility of multipurpose canisters for transporting, storing, and sing of Department of Energy research and production spent nuclear fuel. Six representative Department of Energy fuel assemblies were selected, and preconceptual canister designs were developed to accommodate these assemblies. The study considered physical interface, structural adequacy, criticality safety, shielding capability, thermal performance of the canisters, and fuel storage site infrastructure. The external envelope of the canisters was designed to fit within the overpack casks for commercial canisters being developed for the Department of Energy Office of Civilian Radioactive Waste Management. The budgetary cost of canisters to handle all fuel considered is estimated at $170.8M. One large conceptual boiling water reactor canister design, developed for the Office of Civilian Radioactive Waste Management, and two new canister designs can accommodate at least 85% of the volume of the Department of Energy fuel considered. Canister use minimizes public radiation exposure and is cost effective compared with bare fuel handling. Results suggest the need for additional study of issues affecting canister use and for conceptual design development of the three canisters.

28016 (FEMP–2341) **System safety analysis of an autonomous mobile robot.** Bartos, R.J. Fernald Environmental Restoration Management Corp., Cincinnati, OH (United States). Fernald Environmental Management Project. [1994]. 67p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-92OR21972. (CONF-9407104–1: 12. international system safety conference, New Orleans, LA (United States), 5-10 Jul 1994). Order Number DE94015815. Source: OSTI; NTIS; INIS; GPO Dep.

Analysis of the safety of operating and maintaining the Stored Waste Autonomous Mobile Inspector (SWAMI) II in a hazardous environment at the Fernald Environmental Management Project (FEMP) was completed. The SWAMI II is a version of a commercial robot, the HelpMate™ robot produced by the Transitions Research Corporation, which is being updated to incorporate the systems required for inspecting mixed toxic chemical and radioactive waste drums at the FEMP. It also has modified obstacle detection and collision avoidance subsystems. The robot will autonomously travel down the aisles in storage warehouses to record images of containers and collect other data which are transmitted to an inspector at a remote computer terminal. A previous study showed the SWAMI II has economic feasibility. The SWAMI II will more accurately locate radioactive contamination than human inspectors. This thesis includes a System Safety Hazard Analysis and a quantitative Fault Tree Analysis (FTA). The objectives of the analyses are to prevent potentially serious events and to derive a comprehensive set of safety requirements from which the safety of the SWAMI II and other autonomous mobile robots can be evaluated. The Computer-Aided Fault Tree Analysis (CAFTA©) software is utilized for the FTA. The FTA shows that more than 99% of the safety risk occurs during maintenance, and that when the derived safety requirements are implemented the rate of serious events is reduced to below one event per million operating hours. Training and procedures in SWAMI II operation and maintenance provide an added safety margin. This study will promote the safe use of the SWAMI II and other autonomous mobile robots in the emerging technology of mobile robotic inspection.

28017 (HW–58485) **Nuclear physics research operation: Monthly report, November 1958.** Faulkner, J.E. Battelle, Columbus, OH (United States). 10 Dec 1958. 18p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE94015962. Source: OSTI; NTIS; GPO Dep.

This report is a summary of projects worked on in support of the production reactors at Hanford. The projects include criticality studies, from tasks associated with fuel element reprocessing to shipments of slightly enriched uranium. They include studies of neutron cross sections for different reactions and neutron flux measurements in different reactor locations, as well as design studies for future reactor projects.

28018 (INIS-JP–018, pp. 343-350) **Soviet-German cooperation in safety improvements of spent fuel transport casks.** Schulz-Forberg, B. (Bundesanstalt Fuer Materialforschung und -pruefung, Berlin (Germany)); Zeisler, P.; Droste, B.; Kondratiev, A.; Kozlov, Ju.; Tichinov, N. 1993. 1709p. (CONF-920905–: PATRAM '92: 10th international symposium on the packaging and transportation of radioactive materials, Yokohama (Japan), 13-18 Sep 1992). In *The 10th international symposium on the packaging and transportation of radioactive materials: Proceedings.* Order Number DE94737964. Source: OSTI; NTIS; INIS.

Composed of three volumes.

The paper gives a survey of the Soviet (Russian)-German activities which started in 1988 with the objective of creating a long-term scientific-technical cooperation in the field of transport and storage casks for spent nuclear fuel. The first step, i.e., the step of informing each other about the state of development is done. The more complicated second phase with concerted common activities of both the Russian and German competent Authorities and industrial enterprises is intended to start the in near future. (author).

28019 (INIS-JP–018, pp. 369-376) **Design of high performance spent fuel shipping cask.** Kokaji, Ichizo (Kansai Electric Power Co., Inc., Osaka (Japan)); Tanaka, Kenichi; Fukazawa, Akio. 1993. 1709p. (CONF-920905–: PATRAM '92: 10th international symposium on the packaging and transportation of radioactive materials, Yokohama (Japan), 13-18 Sep 1992). In *The 10th international symposium on the packaging and transportation of radioactive materials: Proceedings.* Order Number DE94737964. Source: OSTI; NTIS; INIS.

Composed of three volumes.

In consideration of high burn-up plan for LWR fuel and future transportation of spent fuel to the Rokkasho reprocessing plant, the High Performance Spent Fuel Shipping Cask (HP-Cask) has been developed to transport more contents (number of fuel assemblies) than the existing casks. (J.P.N.).

28020 (INIS-JP–018, pp. 393-397) **Conceptual evaluation of type B(U) casks for the nuclear power plants of Argentina.** Florido, P.C. (Comision Nacional de Energia Atomica, San Carlos de Bariloche (Argentina). Centro Atomico Bariloche); Isnardi, E.R. 1993. 1709p. (CONF-920905–: PATRAM '92: 10th international symposium on the packaging and transportation of radioactive materials, Yokohama (Japan), 13-18 Sep 1992). In *The 10th*

international symposium on the packaging and transportation of radioactive materials: Proceedings. Order Number DE94737964. Source: OSTI; NTIS; INIS.

Composed of three volumes.

In Argentina two different nuclear power plants are in operation, Atucha I (PHWR-Siemens) and Embalse (PHWR-CANDU). Thus two very different fuel elements could be potentially transported. In order to optimize the research and development needed for the design and construction of the cask, the cost-benefit and flexibility of the engineering solutions are studied, for the two fuel elements. Different casks, for both types of existing fuel elements (Atucha I and Embalse), for different burnup-levels (regarding the advanced fuel cycle available), decay times, distances, and transported weight were studied. Three materials for shielding were used: uranium lead and steel. Only transport by road was considered, due to the reduced availability of the train. In this stage (conceptual design) small, easy and fast computer programs should be used. The principal issues that have to be fixed are shielding properties, thermal effects and mechanical behavior. As a result of the evaluation, different options for the casks were founded, as well as the importance of different parameters and the effect of two different designs of fuel elements. (author).

28021 (INIS-JP–018, pp. 398-405) **Transportation cask contamination weeping: A program leading to prevention.** Bennett, P.C. (Sandia National Lab., Albuquerque, NM (United States)); Doughty, D.H.; Chambers, W.B. 1993. 1709p. (CONF-920905–: PATRAM '92: 10th international symposium on the packaging and transportation of radioactive materials, Yokohama (Japan), 13-18 Sep 1992). In *The 10th international symposium on the packaging and transportation of radioactive materials: Proceedings.* Order Number DE94737964. Source: OSTI; NTIS; INIS.

Composed of three volumes.

This paper describes the problem of cask contamination weeping, and efforts to understand the phenomenon and to eliminate its occurrence during spent nuclear fuel transport. The paper summarizes analyses of field experience and scoping experiments, and concentrates on current modelling and experimental validation efforts. (J.P.N.).

28022 (INIS-JP–018, pp. 406-413) **Development of the BNFL Vitrified Residue Transport Flask.** Gowing, R. (British Nuclear Fuels plc, Risley (United Kingdom)); Hunter, I.J.; Cory, A.R.; Ohashi, Masao. 1993. 1709p. (CONF-920905–: PATRAM '92: 10th international symposium on the packaging and transportation of radioactive materials, Yokohama (Japan), 13-18 Sep 1992). In *The 10th international symposium on the packaging and transportation of radioactive materials: Proceedings.* Order Number DE94737964. Source: OSTI; NTIS; INIS.

Composed of three volumes.

The BNFL Vitrified Residue Flask has been designed by Nuclear Transport Limited (NTL), an associated company of BNFL. The body comprises a cylindrical shell and base manufactured from forged carbon manganese steel, with a stainless steel lid bolted to it. Silicon rubber neutron shielding is encapsulated in compartments at the flask ends and between the cooling fins. Removable shock absorbers are bolted to both ends, and two pairs of bolted trunnions are fitted for lifting and tie-down. The flask carries 21 vitrified residue containers in a support structure made up of 30 cast aluminium segments secured by a bolting system to the internal flask cavity. This assembled support structure forms seven circular channels to receive the vitrified residue containers. (J.P.N.).

28023 (INIS-JP–018, pp. 1091-1097) **Development of a brittle fracture acceptance criterion for the International Atomic Energy Agency (IAEA).** Sorenson, K.B. (Sandia National Labs., Albuquerque NM (United States)); Salzbrenner, R.; Nickell, R.E. 1993. 1709p. (CONF-920905–: PATRAM '92: 10th international symposium on the packaging and transportation of radioactive materials, Yokohama (Japan), 13-18 Sep 1992). In *The 10th international symposium on the packaging and transportation of radioactive materials: Proceedings.* Order Number DE94737964. Source: OSTI; NTIS; INIS.

Composed of three volumes.

An effort has been undertaken to develop a brittle fracture acceptance criterion for structural components of nuclear material transportation casks. The need for such a criterion was twofold. First, new generation cask designs have proposed the use of ferritic steels and other materials to replace the austenitic stainless steel commonly used for structural components in transport casks. Unlike austenitic stainless steel which fails in a high-energy absorbing, ductile tearing mode, it is possible for these candidate materials to fail via brittle fracture when subjected to certain combinations of elevated loading rates and low temperatures. Second, there is no established brittle fracture criterion accepted by the regulatory community that covers a broad range of structural materials. Although the existing IAEA Safety Series no.37 addressed brittle fracture, its the guidance was dated and pertained only to ferritic steels. Consultant's Services Meetings held under the auspices of the IAEA have resulted in a recommended brittle fracture criterion. The brittle fracture criterion is based on linear elastic fracture mechanics, and is the result of a consensus of experts from six participating IAEA-member countries. The brittle fracture criterion allows three approaches to determine the fracture toughness of the structural material. The three approaches present the opportunity to balance material testing requirements and the conservatism of the material's fracture toughness which must be used to demonstrate resistance to brittle fracture. This work has resulted in a revised Appendix IX to Safety Series no.37 which will be released as an IAEA Technical Document within the coming year. (author).

28024 (INIS-JP–018, pp. 1105-1112) **Brittle fracture tests at low temperature for transport cask materials.** Kosaki, Akio (Central Research Inst. of Electric Power Industry, Abiko, Chiba (Japan). Abiko Research Lab.); Ito, Chihiro; Arai, Taku; Saegusa, Toshiari. 1993. 1709p. (CONF-920905–: PATRAM '92: 10th international symposium on the packaging and transportation of radioactive materials, Yokohama (Japan), 13-18 Sep 1992). In *The 10th international symposium on the packaging and transportation of radioactive materials: Proceedings.* Order Number DE94737964. Source: OSTI; NTIS; INIS.

Composed of three volumes.

The IAEA Regulations for the Safe Transport of Radioactive Material were revised in 1985, and brittle fracture assessment at low temperature for transport packages are now required. This report discusses the applicability of the actual method for brittle fracture assessment of type-B transport cask materials used in JAPAN. The necessity of brittle fracture assessment at low temperature was estimated for each material of type-B transport casks used in Japan and the applicability was investigated. Dynamic fracture toughness values, $K_{Id}(J_{Id})$, and RT_{NDT} values of Low-Mn Carbon Steels, that are SA 350 Gr.LF1 Modify and SA 516 Gr.70 material which used in type-B transport cask body, were also obtained to check whether or not an easier and conventional test method, that prescribed in ASME CODE SECTION III, can be substituted for the dynamic fracture test method. And for bolt materials, which include 1.8Ni-0.8Cr-0.3Mo Carbon Steel and type 630 H Stainless Steel, toughness data were obtained for reference. (J.P.N.).

28025 (INIS-JP–018, pp. 1113-1120) **Investigation into the use of ductile cast iron and cast steel for transport containers with plastic flow shock absorbers.** Smith, M.J.S. (United Kingdom Nirex Ltd., Harwell (United Kingdom)); Gray, I.L.S; Sievwright, R.W.T.; Miles, J.C.; Egid, B.; Donelan, P. 1993. 1709p. (CONF-920905–: PATRAM '92: 10th international symposium on the packaging and transportation of radioactive materials, Yokohama (Japan), 13-18 Sep 1992). In *The 10th international symposium on the packaging and transportation of radioactive materials: Proceedings.* Order Number DE94737964. Source: OSTI; NTIS; INIS.

Composed of three volumes.

UK Nirex Ltd is responsible for the development of facilities for the disposal of low and intermediate level waste in the United Kingdom, including the development of the transport facilities for this waste. As part of the development programme Nirex is examining the feasibility of manufacturing these transport containers by means of casting instead of the more usual forging process, as this would bring advantages of lower cost and shorter manufacturing time. This paper describes the programme of work to date which has been aimed at establishing the feasibility of utilizing casting as the manufacturing method for the ILW transport containers and selecting one of the materials for further development work. (J.P.N.).

28026 (INIS-JP–018, pp. 1123-1129) **Report on the joint USA-Germany drop test program for a vitrified high level waste cask.** Golliher, K.G. (USDOE, Albuquerque Operations Office, NM (United States)); Witt, C.R.; Wieser, K.E. 1993. 1709p. (CONF-920905–: PATRAM '92: 10th international symposium on the packaging and transportation of radioactive materials, Yokohama (Japan), 13-18 Sep 1992). In *The 10th international symposium on the packaging and transportation of radioactive materials: Proceedings.* Order Number DE94737964. Source: OSTI; NTIS; INIS.

Composed of three volumes.

A series of full-scale drop tests was performed on a ductile iron transport cask in a cooperative program between the US Department of Energy (DOE) and Bundesantalt fuer Materialpruefung (BAM) in Germany. The tests, which were performed at BAM's test facility located near Lehre, Germany, were performed on a prototype cask designed for transport of Vitrified High Level Waste (VHLW) canisters. The VHLW cask is a right circular cylinder with a diameter of 1156 mm and a height of 3454 cm, and weighs approximately 24.6 kg including its payload of a single VHLW canister. The drop tests were performed with a non-radioactive, prototype VHLW canister in the cavity. (J.P.N.).

28027 (INIS-JP–018, pp. 1130-1137) **Evaluation of the impact behavior of the contents of reprocessing radioactive waste shipping cask subjected to drop impact.** Shirai, K. (Central Research Inst. of Electric Power Industry, Abiko, Chiba (Japan). Abiko Research Lab.); Ito, C.; Funahashi, M. 1993. 1709p. (CONF-920905–: PATRAM '92: 10th international symposium on the packaging and transportation of radioactive materials, Yokohama (Japan), 13-18 Sep 1992). In *The 10th international symposium on the packaging and transportation of radioactive materials: Proceedings.* Order Number DE94737964. Source: OSTI; NTIS; INIS.

Composed of three volumes.

In this study, to investigate the impact response characteristics of the contents in the cask precisely, we performed the laboratory-scale drop tests, and on the basis of the test results, we proposed the construction of the spring-mass model and confirmed the accuracy of the proposed drop analysis method by comparison with drop test using a full-scale cask for high level wastes. Following the results of the drop tests and analysis, the outline of the contents and results is summarized below. (1) The drop tests onto the unyielding surface using a scale model containing several contents were performed and the effect of the interaction between the contents and the cask body on the impact response experimentally. (2) The above interaction can be characterized by the gap between the contents and the cask body caused by the release of the gravitational force at the moment the drop started. So, we proposed the analysis method for considering gap using spring-mass model by comparing the laboratory-scale drop test results. (3) We applied the proposed analysis method to a drop test using a full-scale cask for high level wastes, and it was found that this method seems to be good and convenient enough to evaluate the impact behavior of the contents in a transport cask subjected to drop impact. (J.P.N.).

28028 (INIS-JP–018, pp. 1171-1178) **Experience of maintenance of the HZ-75T cask in Japan.** Katoh, T. (Ocean Cask Lease Co. Ltd., Tokyo (Japan)); Ozaki, S.; Misawa, K.; Tahara, Y. 1993. 1709p. (CONF-920905–: PATRAM '92: 10th international symposium on the packaging and transportation of radioactive materials, Yokohama (Japan), 13-18 Sep 1992). In *The 10th international symposium on the packaging and transportation of radioactive materials: Proceedings.* Order Number DE94737964. Source: OSTI; NTIS; INIS.

Composed of three volumes.

The HZ-75T Spent Fuel Shipping Casks have been used in domestic transportation of spent fuel from 10(ten) nuclear power plants to the Tokai Reprocessing Plant of Power Reactor and Nuclear Fuel Development Corporation. As of August 1991 a total of 100 Shipments (number of casks; 200, about 600 MTU) have been made. The HZ-75T Casks are strictly controlled in accordance with the proper maintenance program for the long term use. By application of the appropriate periodic inspections and maintenances, the soundness of casks have been kept perfectly at any time. To continue these activities, it is planned to use the HZ-75T Casks for the domestic transportation of spent fuels for long further. These experiences of maintenance activities of the HZ-75T Casks are given in this paper. (J.P.N.).

28029 (INIS-JP–018, pp. 1181-1188) **Results of the Sandia National Laboratories MOSAIK cask drop test program.** Sorenson, K. (Sandia National Labs., Albuquerque, NM (United States)); Salzbrenner, R.; Wellman, G.; Bobbe, J. 1993. 1709p. (CONF-920905–: PATRAM '92: 10th international symposium on the packaging and transportation of radioactive materials, Yokohama (Japan), 13-18 Sep 1992). In *The 10th international symposium on the packaging and transportation of radioactive materials: Proceedings.* Order Number DE94737964. Source: OSTI; NTIS; INIS.

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The MOSAIK Drop Test Program at Sandia National Laboratories provides a rigorous demonstration that an LEFM approach to cask design is conservative. Further, it shows that ductile iron is an appropriate material of construction for structural components of RAM transport casks. Results of this test should be used in a complementary fashion with programs from other organizations to provide a background of engineering data that will assure cask owners and regulators alike that LEFM is an appropriately conservative method for designing casks and evaluating cask structural components for the risk of brittle fracture. (J.P.N.).

28030 (INIS-JP–018, pp. 1197-1205) **Extended drop testing with precracked DCI-casks and evaluations on safety against brittle fracture.** Wieser, K.E. (Bundesanstalt fuer Materialforschung und -pruefurg, Berlin (Germany)); Frenz, H.; Gogolin, B. 1993. 1709p. (CONF-920905–: PATRAM '92: 10th international symposium on the packaging and transportation of radioactive materials, Yokohama (Japan), 13-18 Sep 1992). In *The 10th international symposium on the packaging and transportation of radioactive materials: Proceedings.* Order Number DE94737964. Source: OSTI; NTIS; INIS.

Composed of three volumes.

This paper is a summary of a research study as part of comparable efforts in Japan, France and the USA aimed at developing principles, procedures and material data for the brittle fracture safe design of thickwalled shipping containers made from ductile cast iron (DCI) and other material susceptible - in principle - to nonductile failure. Furthermore, the application of fracture mechanics was to be qualified as an alternative method, relative to the experimental approach applied in previous licensing procedures in Germany and to be demonstrated by subjecting a full-size precracked prototype to drop tests. (J.P.N.).

28031 (INIS-JP–018, pp. 1206-1213) **Mechanical properties used for the qualification of transport casks: Prototype development and extension to serial production.** Salzbrenner, R. (Sandia National Labs., Albuquerque, NM (United States)); Crenshaw, T.B.; Sorenson, K.B. 1993. 1709p. (CONF-920905–: PATRAM '92: 10th international symposium on the packaging and transportation of radioactive materials, Yokohama (Japan), 13-18 Sep 1992). In *The 10th international symposium on the packaging and transportation of radioactive materials: Proceedings.* Order Number DE94737964. Source: OSTI; NTIS; INIS.

Composed of three volumes.

The qualification process that should be sufficient for qualification of a specific cask (material/geometry combination) has been examined. The prototype cask should be tested to determine its overall variation in microstructure, chemistry, and mechanical properties. This prototype may also be subjected to 'proof testing' to demonstrate the validity of the design analysis (including the mechanical properties used in the analysis). The complete mechanical property mapping does not necessarily have to precede the proof testing (i.e., portions of the cask which experience only low (elastic) loads during the drop test are suitable for mechanical test specimens). The behavior of the prototype cask and the production casks are linked by assuring that each cask possesses at least the minimum level of one or more critical mechanical properties. This may be done by measuring the properties of interest directly, or by relying on a secondary measurement (such as subsize mechanical test results or microstructure/compositional measurements) which has been statistically correlated to the critical properties. The database

required to show the correlation between the secondary measurement and the valid design property may be established by tests on the material from the prototype cask. The production controls must be demonstrated as being adequate to assure that a uniform product is produced. The testing of coring (or test block or prolongation) samples can only be viewed as providing a valid link to the benchmark results provided by the prototype cask if the process used to create follow-on casks remains essentially similar. The MOSAIK Test Program has demonstrated the qualification method through the benchmarking stage. The program did not establish for qualifying serial production casks through, for example, a correlation between small specimen parameters and valid design fracture toughness properties. Such a correlation would require additional experimental work. (J.P.N.).

28032 (INIS-JP–018, pp. 1632-1638) **Development of design and safety analysis supporting system for casks.** Ohsono, Katsunari (Mitsubishi Heavy Industries Ltd., Kobe (Japan). Kobe Shipyard and Machinery Works); Higashino, Akira; Endoh, Shuji. 1993. 1709p. (CONF-920905–: PATRAM '92: 10th international symposium on the packaging and transportation of radioactive materials, Yokohama (Japan), 13-18 Sep 1992). In *The 10th international symposium on the packaging and transportation of radioactive materials: Proceedings.* Order Number DE94737964. Source: OSTI; NTIS; INIS.

Composed of three volumes.

Mitsubishi heavy Industries has developed a design and safety analysis supporting system 'CADDIE' (Cask Computer Aided Design, Drawing and Integrated Evaluation System), with the following objectives: (1) Enhancement of efficiency of the design and safety analysis (2) Further advancement of design quality (3) Response to the diversification of design requirements. The features of this system are as follows: (1) The analysis model data common to analyses is established, and it is prepared automatically from the model made by CAD. (2) The input data for the analysis code is available by simple operation of conversation type from the analysis model data. (3) The analysis results are drawn out in diagrams by output generator, so as to facilitate easy observation. (4) The data of material properties, fuel assembly data, etc. required for the analyses are made available as a data base. (J.P.N.).

28033 (LA-SUB–94-108) **Criticality calculations with MCNP™: A primer.** Harmon, C.D. II (New Mexico Univ., Albuquerque, NM (United States)); Busch, R.D.; Briesmeister, J.F.; Forster, R.A. Los Alamos National Lab., NM (United States); New Mexico Univ., Albuquerque, NM (United States). 6 Jun 1994. 174p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. Order Number DE94016571. Source: OSTI; NTIS; INIS; GPO Dep.

With the closure of many experimental facilities, the nuclear criticality safety analyst increasingly is required to rely on computer calculations to identify safe limits for the handling and storage of fissile materials. However, in many cases, the analyst has little experience with the specific codes available at his/her facility. This primer will help you, the analyst, understand and use the MCNP Monte Carlo code for nuclear criticality safety analyses. It assumes that you have a college education in a technical field. There is no assumption of familiarity with Monte Carlo codes in general or with MCNP in particular. Appendix A gives an introduction to Monte Carlo techniques. The primer is designed to teach by example, with each example illustrating two or three features of MCNP that are useful in criticality analyses. Beginning with a Quickstart chapter, the primer gives an overview of the basic requirements for MCNP input and allows you to run a simple criticality problem with MCNP. This chapter is not designed to explain either the input or the MCNP options in detail; but rather it introduces basic concepts that are further explained in following chapters. Each chapter begins with a list of basic objectives that identify the goal of the chapter, and a list of the individual MCNP features that are covered in detail in the unique chapter example problems. It is expected that on completion of the primer you will be comfortable using MCNP in criticality calculations and will be capable of handling 80 to 90 percent of the situations that normally arise in a facility. The primer provides a set of basic input files that you can selectively modify to fit the particular problem at hand.

28034 (ORNL/TM–12710) **A review of the environmental survivability of telerobotic control sensor systems for use in nuclear waste tanks.** Holcomb, D.E.; Burks, B.L. Oak Ridge National Lab., TN (United States). May 1994. 573p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE94015635. Source: OSTI; NTIS; INIS; GPO Dep.

This report was prepared by the Oak Ridge National Laboratory (ORNL) and funded by the Department of Energy (DOE) Office of Technology Development (OTD) Robotics Technology Development Program (RTDP). During the next few years field deployment of remotely operated systems in nuclear waste cleanup operations will increase dramatically as DOE strives to efficiently and safely remediate the many waste storage sites. Typically, the most fragile components in remote systems are the sensors that provide feedback to the operators or to computer control algorithms. The purpose of this review is to determine the availability of environmentally hardened sensors to support control of a manipulator or vehicle system in a waste tank environment. The emphasis of the report is on the environmental ruggedness of currently available sensors. For the purpose of this review a set of nominal requirements for survivability were adopted conditions in the single-shell tanks at Hanford. This report is designed to be a practical guide to the state of the art in commercially available environmentally tolerant sensors for use with robotic systems. It is neither intended to be an exhaustive review of the technical literature on potential measurement techniques nor a complete physical review of the functioning of particular sensor systems. This report is intended to be a living document. As additional, corrected, or updated information is received from sensor manufacturers, it will be incorporated into the report database. The physical report will then be periodically revised and released in updated format. The authors wish to apologize to any sources of environmentally hardened sensors that were omitted during this review and encourage submission of new or updated data.

28035 **Active imaging system with Faraday filter.** Snyder, J.J. To Dept. of Energy. 1992. Filed date 29 Jun 1992. U.S. Patent Application 7-905,989. 16p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. Order Number DE94014884. Source: OSTI; NTIS; GPO Dep.

This invention is comprised of an active imaging system which has a low to medium powered laser transmitter and a receiver wherein the receiver includes a Faraday filter with an ultranarrow optical bandpass and a bare (nonintensified) CCD camera. The laser is locked in the vicinity of the passband of the Faraday filter. The system has high sensitivity to the laser illumination wile eliminating solar background.

28036 **Voltage control in pulsed systems by predict ahead control.** Payne, A.N.; Watson, J.A.; Sampayan, S.E. To Dept. of Energy. 1992. Filed date 21 Aug 1992. U.S. Patent Application 7-933,154. 14p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. Order Number DE94016118. Source: OSTI; NTIS; GPO Dep.

A method and apparatus for predict-ahead pulse-to-pulse voltage control in a pulsed power supply system is disclosed. A DC power supply network is coupled to a resonant charging network via a first switch. The resonant charging network is coupled at a node to a storage capacitor. An output load is coupled to the storage capacitor via a second switch. A de-Q-ing network is coupled to the resonant charging network via a third switch. The trigger for the third switch is a derived function of the initial voltage of the power supply network, the initial voltage of the storage capacitor, and the present voltage of the storage capacitor. A first trigger closes the first switch and charges the capacitor. The third trigger is asserted according to the derived function to close the third switch. When the third switch is closed, the first switch opens and voltage on the node is regulated. The second trigger may be thereafter asserted to discharge the capacitor into the output load.

28037 (PNL-SA–23990) **Laser alignment of rotating equipment at PNL.** Berndt, R.H. Pacific Northwest Lab., Richland, WA (United States). May 1994. 17p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. (CONF-9405192–1: Nuclear facility PdM symposium, Atlanta, GA

(United States), 16 May - 18 jun 1994). Order Number DE94014430. Source: OSTI; NTIS; INIS; GPO Dep.

Lateral vibration in direct-drive equipment is usually caused by misalignment. Over the years, because of the need to improve on techniques and ways of working more efficiently, various types of alignment methods have evolved. In the beginning, craftsmen used a straight-edge scale across the coupling with a feeler gauge measuring the misalignment error. This is still preferred today for aligning small couplings. The industry has since decided that alignment of large direct-drive equipment needed a more accurate type of instrumentation. Rim and face is another of the first alignment methods and is used on all sizes of equipment. A disadvantage of the rim and face method is that in most cases the coupling has to be disassembled. This can cause alignment problems when the coupling is reassembled. Also, the rim and face method is not fast enough to work satisfactorily on alignment of thermally hot equipment. Another concern is that the coupling has to be manufactured accurately for correct rim and face readings. Reverse dial alignment is an improvement over the rim and face method, and depending on the operator's experience, this method can be very accurate. A good training program along with field experience will bring the operator to a proper level of proficiency for a successful program. A hand-held computer with reverse dial calculations in memory is a must for job efficiency. An advantage over the rim and face method is that the coupling is not disassembled and remains locked together. Reverse dial instrumentation measures from both shaft center lines, rather than the coupling surface so the machining of the coupling during manufacture is not a major concern.

28038 (SAND–94-0481C) **Developing communications requirements for Agile Product Realization.** Forsythe, C.; Ashby, M.R. Sandia National Labs., Albuquerque, NM (United States). [1994]. 12p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. (CONF-941070–1: Computer supported cooperative symposium, Chapel Hill, NC (United States), 22-26 Oct 1994). Order Number DE94007856. Source: OSTI; NTIS; GPO Dep.

Sandia National Laboratories has undertaken the Agile Product Realization for Innovative electroMEchanical Devices (A-PRIMED) pilot project to develop and implement technologies for agile design and manufacturing of electrochemical components. Emphasis on information-driven processes, concurrent engineering and multifunctional team communications makes computer-supported cooperative work critical to achieving significantly faster product development cycles. This report describes analyses conducted in developing communications requirements and a communications plan that addresses the unique communications demands of an agile enterprise.

28039 (SAND–94-0624C) **Interferometric synthetic aperture radar terrain elevation mapping from multiple observations.** Ghiglia, D.C.; Wahl, D.E. Sandia National Labs., Albuquerque, NM (United States). [1994]. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. (CONF-941090–2: Institute of Electrical and Electronics Engineers (IEEE) digital signal processing workshop, Yosemite, CA (United States), 3-5 Oct 1994). Order Number DE94014185. Source: OSTI; NTIS; GPO Dep.

All prior interferometric SAR imaging experiments to date dealt with pairwise processing. Simultaneous image collections from two antenna systems or two-pass single antenna collections are processed as interferometric pairs to extract corresponding pixel by pixel phase differences which encode terrain elevation height. The phase differences are wrapped values which must be unwrapped and scaled to yield terrain height. We propose two major classes of techniques that hold promise for robust multibaseline (multiple pair) interferometric SAR terrain elevation mapping. The first builds on the capability of a recently published method for robust weighted and unweighted least-squares phase unwrapping, while the second attacks the problem directly in a maximum likelihood (ML) formulation. We will provide several examples (actual and simulated SAR imagery) that illustrate the advantages and disadvantages of each method.

28040 (SAND–94-1175C) **New approach to strip-map SAR autofocus.** Wahl, D.; Jakowatz, C.; Thompson, P.; Ghiglia, D. Sandia National Labs., Albuquerque, NM (United States). [1994]. 2p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. (CONF-941090–1: Institute of Electrical and Electronics Engineers (IEEE) digital signal processing workshop, Yosemite, CA (United States), 3-5 Oct 1994). Order Number DE94010808. Source: OSTI; NTIS; GPO Dep.

Means for removing phase errors induced in spotlight mode synthetic aperture radar (SAR) imagery are now well-established. The Phase Gradient Autofocus (PGA) algorithm has been shown to be robust over a wide range of spotlight mode imagery and phase error functions. These phase errors could have their origin either in uncompensated platform motion or random propagation delays incurred, for example, from tropospheric turbulence. The PGA technique, however, cannot be directly applied to imagery formed in the conventional strip-mapping mode. In this paper we show that if the fundamental ideas of PGA are modified in an appropriate way, the phase errors in strip-map imagery can be effectively estimated and compensated.

28041 (SAND–94-8621) **Selecting the best defect reduction methodology.** Hinckley, C.M. (Sandia National Labs., Albuquerque, NM (United States)); Barkan, P. Sandia National Labs., Albuquerque, NM (United States). Apr 1994. 31p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DR00789. Order Number DE94015782. Source: OSTI; NTIS; GPO Dep.

Defect rates less than 10 parts per million, unimaginable a few years ago, have become the standard of world-class quality. To reduce defects, companies are aggressively implementing various quality methodologies, such as Statistical Quality Control Motorola's Six Sigma, or Shingo's poka-yok. Although each quality methodology reduces defects, selection has been based on an intuitive sense without understanding their relative effectiveness in each application. A missing link in developing superior defect reduction strategies has been a lack of a general defect model that clarifies the unique focus of each method. Toward the goal of efficient defect reduction, we have developed an event tree which addresses a broad spectrum of quality factors and two defect sources, namely, error and variation. The Quality Control Tree (QCT) predictions are more consistent with production experience than obtained by the other methodologies considered independently. The QCT demonstrates that world-class defect rates cannot be achieved through focusing on a single defect source or quality control factor, a common weakness of many methodologies. We have shown that the most efficient defect reduction strategy depend on the relative strengths and weaknesses of each organization. The QCT can help each organization identify the most promising defect reduction opportunities for achieving its goals.

28042 (UCRL-CR–117775) **Aerodynamic, structural, and trajectory analysis of ASTRID-1 vehicle.** Glover, L.S.; Iwaskiw, A.P.; Oursler, M.A.; Perini, L.L.; Schaefer, E.D. Lawrence Livermore National Lab., CA (United States); Johns Hopkins Univ., Laurel, MD (United States). Applied Physics Lab. 10 Feb 1994. 57p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. Order Number DE94015181. Source: OSTI; NTIS; GPO Dep.

The Johns Hopkins University/Applied Physics Laboratory, JHU/APl, in support of Lawrence Livermore National Laboratory, LLNL, is conducting aerodynamic, trajectory, and structural analysis of the Advanced Single Stage Technology Rapid Insertion Demonstration (ASTRID) vehicle, being launched out of Vandenberg Air Force Base (VAFB) in February 1994. The launch is designated ASTRID-1 and is the first in a series of three that will be launched out of VAFB. Launch dates for the next two flights have not been identified, but they are scheduled for the 1994-1995 time frame. The primary goal of the ASTRID-1 flight is to test the LLNL light weight thrust on demand bi-propellant pumped divert propulsion system. The system is employed as the main thrusters for the ASTRID-1 vehicle and uses hydrazine as the mono-propellant. The major conclusions are: (1) The vehicle is very stable throughout flight (stability margin = 17 to 24 inches); (2) The aerodynamic frequency and the roll rate are such that pitch-roll interactions will be small; (3) The high stability margin combined with the high launcher elevation angle makes the vehicle flight path highly sensitive to perturbations

during the initial phase of flight, i.e., during the first second of flight after leaving the rail; (4) The major impact dispersions for the test flight are due to winds. The wind impact dispersions are 90% dictated by the low altitude, 0 to 1000 ft., wind conditions; and (5) In order to minimize wind dispersions, head wind conditions are favored for the launch as November VAFB mean tail winds result in land impacts. The ballistic wind methodology can be employed to assess the impact points of winds at the launch site.

28043 (WINCO–1218) **White Paper: Multi-purpose canister (MPC) for DOE-owned spent nuclear fuel (SNF).** Knecht, D.A. Westinghouse Idaho Nuclear Co., Inc., Idaho Falls, ID (United States). Apr 1994. 34p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-84ID12435. Order Number DE94016421. Source: OSTI; NTIS; INIS; GPO Dep.

The paper examines the issue, What are the advantages, disadvantages, and other considerations for using the MPC concept as part of the strategy for interim storage and disposal of DOE-owned SNF? The paper is based in part on the results of an evaluation made for the DOE National Spent Fuel Program by the Waste Form Barrier/Canister Team, which is composed of knowledgeable DOE and DOE-contractor personnel. The paper reviews the MPC and DOE SNF status, provides criteria and other considerations applicable to the issue, and presents an evaluation, conclusions, and recommendations. The primary conclusion is that while most of DOE SNF is not currently sufficiently characterized to be sealed into an MPC, the advantages of standardized packages in handling, reduced radiation exposure, and improved human factors should be considered in DOE SNF program planning. While the design of MPCs for DOE SNF are likely premature at this time, the use of canisters should be considered which are consistent with interim storage options and the MPC design envelope.

4204 Heat Transfer and Fluid Flow

Refer also to citation(s) 27220, 27615, 27666, 27848

28044 (ANL/ES/CP–83265) **Numerical analyses of experimental NMR slurry velocities and concentrations.** Lyczkowski, R.W.; Bouillard, J.X.; Ding, J. Argonne National Lab., IL (United States). 5 May 1994. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-940817–1: World congress in particle technology, Denver, CO (United States), 17-20 Aug 1994). Order Number DE94015063. Source: OSTI; NTIS; GPO Dep.

The flow of solids-loaded suspensions in pipes are of great interest in many industrial manufacturing processes, such as manufacture of solid rocket propellants, advanced ceramics, and reinforced polymer composites; also in heterogeneous catalytic reactors, pipeline transport of suspensions, and in the food/paper industries. Analyses of the steady-state, fully developed isothermal carrier fluid velocity and solids concentration (NMR) data of Altobelli et al. and Sinton and Chow are presented using the SLUFIX and COMMIX-M codes.

28045 (ANL/RE/CP–79355) **Modeling of heat transfer in a horizontal heat-generating layer by an effective diffusivity approach.** Cheung, F.B. (Pennsylvania State Univ., University Park, PA (United States). Dept. of Mechanical Engineering); Shiah, S.W.; Cho, D.H.; Tan, M.J. Argonne National Lab., IL (United States). [1994]. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-920804–28: 28. national heat transfer conference, San Diego, CA (United States), 9-12 Aug 1992). Order Number DE94014978. Source: OSTI; NTIS; INIS; GPO Dep.

The concept of effective diffusivity is employed to model various processes of heat transfer in a volumetrically heated fluid layer subjected to different initial and boundary conditions. The approach, which involves the solution of only heat diffusion equations, is found to give rather accurate predictions of the transient response of an initially stagnant fluid layer to a step input of power as well as the developing and decaying nature of the flow following a step change in the internal Rayleigh number from one state of steady convection to another. The approach is also found to be applicable to various flow regions of a heat-generating fluid layer, and is not limited to the case in which the entire layer is in turbulent motion. The simplicity and accuracy of the method are clearly illustrated in the analysis. Validity of the effective diffusivity approach is demonstrated by comparing the predicted results with corresponding experimental data.

28046 (LBL–35669) **A new procedure for measuring contact angle.** Concus, P. (Lawrence Berkeley Lab., CA (United States)); Finn, R. Lawrence Berkeley Lab., CA (United States). May 1994. 5p. Sponsored by USDOE, Washington, DC (United States);National Aeronautics and Space Administration, Washington, DC (United States);National Science Foundation, Washington, DC (United States). DOE Contract AC03-76SF00098. Grant NCC3-329; Grant DMS89-02831. (CONF-940799–1: International workshop on short-term experiments under strongly reduced gravity conditions, Bremen (Germany), 4-7 Jul 1994). Order Number DE94014971. Source: OSTI; NTIS; GPO Dep.

Described here are some recent work regarding the mathematic design of apparatus that exploits microgravity conditions for accurate experimental determination of contact angle. The underlying motivation for the procedures rests on a discontinuous dependence of the capillary free surface interface S on the contact angle γ, in a cylindrical capillary tube whose section (base) Ω contains a protruding corner with opening angle 2α.

28047 (LBL–35707) **An investigation of the vortex method.** Pryor, D.W. Jr. Lawrence Berkeley Lab., CA (United States). May 1994. 160p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00098. Order Number DE94014931. Source: OSTI; NTIS; GPO Dep.

The vortex method is a numerical scheme for solving the vorticity transport equation. Chorin introduced modern vortex methods. The vortex method is a Lagrangian, grid free method which has less intrinsic diffusion than many grid schemes. It is adaptive in the sense that elements are needed only where the vorticity is non-zero. Our description of vortex methods begins with the point vortex method of Rosenhead for two dimensional inviscid flow, and builds upon it to eventually cover the case of three dimensional slightly viscous flow with boundaries. This section gives an introduction to the fundamentals of the vortex method. This is done in order to give a basic impression of the previous work and its line of development, as well as develop some notation and concepts which will be used later. The purpose here is not to give a full review of vortex methods or the contributions made by all the researchers in the field. Please refer to the excellent review papers in Sethian and Gustafson, chapters 1 Sethian, 2 Hald, 3 Sethian, 8 Chorin provide a solid introduction to vortex methods, including convergence theory, application in two dimensions and connection to statistical mechanics and polymers. Much of the information in this review is taken from those chapters, Chorin and Marsden and Batchelor, the chapters are also useful for their extensive bibliographies.

28048 (PSI–94-06) **The initial phase of sudden releases of superheated liquid.** Schmidli, J. (Paul Scherrer Inst. (PSI), Villigen (Switzerland)). Paul Scherrer Inst. (PSI), Villigen (Switzerland); Eidgenoessische Technische Hochschule, Zurich (Switzerland). Apr 1994. 169p. Order Number DE94627982. Source: OSTI; NTIS; INIS.

Diss. ETH Nr. 10391.

The catastrophic failure of a pressure vessel containing a liquefied substance, leading to an instantaneous release of its whole contents is a major technological hazard. Due to the rapid depressurization caused by vessel failure, the fluid becomes superheated and unstable. Part of the fluid will evaporate using its internal energy and the two-phase mixture forming will be accelerated. This flashing process can be very violent. In the past, a number of dispersion models were developed to predict the history of an instantaneous release. In most of these models the source term is considered to be a gas volume at rest and not a rapidly expanding aerosol. Furthermore, it is usually assumed that all of the remaining fluid is entrained into the expanding cloud and nothing is deposited on the ground to form a pool. This work concentrates on the initial phase of the sudden release of superheated liquids with the aim to gain a better understanding of the flashing process and of the physical mechanisms involved, leading to a reliable prediction of the source term. Therefore, more than 400 experiments with

propane, butane, refrigerant 12 and 114 were conducted. The experiments were initiated by shattering spherical glass flasks of different sizes. The main parameters varied were the liquid superheat and the filling level of the vessel. Using high-speed measurement devices, it was possible to study the initial phase of such releases during which gravity plays no role. For sufficiently large released internal energy, the initial evolution of the release was always spherical with a constant radial expansion velocity during he first milliseconds until instabilities appeared at the surface of the droplet/vapor cloud that was formed. For all the experimental conditions, the fraction of the initial liquid falling on the ground and forming a pool was significant and therefore has to be considered.

4205 Materials Testing

Refer also to citation(s) 27567, 27615, 27639, 28080, 28374

28049 (ANL/ET/CP–81718) **High-resolution millimeter-wave imaging system for defect characterization in dielectric slabs.** Bakhtiari, S.; Gopalsami, N.; Raptis, A.C.; Lepper, M.J. Argonne National Lab., IL (United States). Energy Technology Div. [1994]. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-940723–11: Annual meeting of the Society of Photo-Optical Instrumentation Engineers, San Diego, CA (United States), 24-29 Jul 1994). Order Number DE94016300. Source: OSTI; NTIS; GPO Dep.

Preliminary results are presented for a millimeter-wavelength free-space imaging system used to detect and characterize defects in layered dielectric composite slabs. Such systems throughout the microwave spectrum have shown great potential as alternative nondestructive evaluation tools for on-line, in-situ examination of low-loss dielectric materials such as plastics, ceramics, and various dielectric composites. Results of a fixed-frequency W-band imaging system operating in either through-transmission or reflection mode are presented here. Incorporation of focused-beam antennas allows high-resolution measurement of small variations within the sample under test. The results are based on measurement of the relative amplitude and phase of the reflected or transmitted wave in monostatic or bistatic configurations, respectively. With proper calibration, the measured parameters can be used to estimate dielectric property variations within the material media. A theoretical simulation for plane wave propagation in a multilayered media is used to interpret the measurement results.

28050 (IKE–6-188) **Neutron CT with a multi-detector system leading to drastical reduction of the measuring time.** Hehn, G.; Pfister, G.; Schatz, A.; Goebel, J.; Kofler, R. Stuttgart Univ. (Germany). Inst. fuer Kernenergetik und Energiesysteme. Sep 1993. 119p. (In German). Order Number DE94785957. Source: OSTI; NTIS (US Sales Only); INIS.

By means of numerical simulation methods and their verification with measurements it could be shown that such a detector system can be realized for a line beam and 1-2 detectors per cm. With the maximum available beam width of the fast neutron field at the FRM approximately 20 detectors can be used leading to a reduction of the measuring time to 0,5 - 1 hour. A multi detector system for a line beam of thermal neutrons was constructed, tested and used for CT-measurements. This detector system for the measurement of thinner layers with better spatial resolution could be realized. The electronic discrimination between neutrons and gamma rays has been improved. This discrimination was used in all CT-measurements to get transmission values of both kinds of radiation and to reconstruct to complementary CT-images. The use of a polyenergetic radiation causes spectral shifts in the transmission spectrum leading to artifacts in the reconstructed CT-image. The transmission values must be spectral corrected before image reconstruction, because the image artifacts complicate the image evaluation or make it impossible. A new energy selective procedure for the online spectral correction was developed. This method is based on the concept to measure additionally to the integral transmission value his pulse height spectrum and to do the correction depending on the changes in this pulse height spectrum. (orig./HP)

28051 (KCP–613-5272) **Automated surface flaw inspection: Final report.** Van Sooy, J.B. Allied-Signal Aerospace Co., Kansas City, MO (United States). Kansas City Div. Apr 1994. 14p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00613. Order Number DE94015861. Source: OSTI; NTIS; GPO Dep.

A study was conducted by Battelle Pacific Northwest Laboratories (PNL) to evaluate the feasibility of automating surface flaw inspection for squib valve housings manufactured at Allied Signal Inc., Kansas City Division (KCD). A borescope/video camera system was developed that was at least equal to the current KCD method in sensitivity to surface flaws. However, the images from this system were not found to be of high enough quality to allow automatic video processing for product acceptance. PNL proposed a three-phase process to further develop automation of this inspection, with the final result being either a partially or fully automated system, depending on the success of the image refinement and software development.

28052 (NUREG/GR–0013) **Applications of a new magnetic monitoring technique to in situ evaluation of fatigue damage in ferrous components.** Jiles, D.C. (Iowa State Univ. of Science and Technology, Ames, IA (United States). Center for Nondestructive Evaluation); Biner, S.B.; Govindaraju, M.R.; Chen, Z.J. Nuclear Regulatory Commission, Washington, DC (United States). Div. of Engineering; Iowa State Univ. of Science and Technology, Ames, IA (United States). Center for Nondestructive Evaluation. Jun 1994. 32p. Sponsored by Nuclear Regulatory Commission, Washington, DC (United States). Source: OSTI; NTIS; INIS; GPO.

This project consisted of research into the use of magnetic inspection methods for the estimation of fatigue life of nuclear pressure vessel steel. Estimating the mechanical and magnetic properties of ferromagnetic materials are closely interrelated, therefore, measurements of magnetic properties could be used to monitor the evolution of fatigue damage in specimens subjected to cyclic loading. Results have shown that is possible to monitor the fatigue damage nondestructively by magnetic techniques. For example, in load-controlled high-cycle fatigue tests, it has been found that the plastic strain and coercivity accumulate logarithmically during the fatigue process. Thus a quantitative relationship between coercivity and the number of fatigue cycles could be established based on two empirical coefficients, which can be determined from the test conditions and material properties. Also it was found that prediction of the onset of fatigue failure in steels was possible under certain conditions. In strain-controlled low cycle fatigue, critical changes in Barkhausen emissions, coercivity and hysteresis loss occurred in the last ten to twenty percent of fatigue life.

28053 (SAND–94-0058C) **Dynamical properties measurements for asteroid, comet and meteorite material applicable to impact modeling and mitigation calculations.** Furnish, M.D. (Sandia National Labs., Albuquerque, NM (United States)); Boslough, M.B.; Gray, G.T. III; Remo, J.L. Sandia National Labs., Albuquerque, NM (United States). [1994]. 11p. Sponsored by USDOE, Washington, DC (United States);Defense Nuclear Agency, Washington, DC (United States). DOE Contract AC04-94AL85000. (CONF-9410131–2: 1994 hypervelocity impact symposium, Santa Fe, NM (United States), 16-20 Oct 1994). Order Number DE94014142. Source: OSTI; NTIS; GPO Dep.

We describe methods for measuring dynamical properties for two material categories of interest in understanding large-scale extraterrestrial impacts: iron-nickel and underdense materials (e.g. snow). Particular material properties measured by the present methods include Hugoniot release paths and constitutive properties (stress vs. strain). The iron-nickel materials lend themselves well to conventional shock and quasi-static experiments. As examples, a suite of experiments is described including six impact tests (wave profile compression/release) over the stress range 2–20 GPa, metallography, quasi-static and split Hopkinson pressure bar (SHPB) mechanical testing, and ultrasonic mapping and sound velocity measurements. Temperature sensitivity of the dynamic behavior was measured at high and low strain rates. Among the iron-nickel materials tested, an octahedrite was found to have behavior close to that of Armco iron under shock and quasi-static conditions, while an ataxite exhibited a significantly larger quasi-static yield strength than did the octahedrite or a hexahedrite. The underdense materials pose three primary experimental difficulties. First, the samples

are friable; they can melt or sublimate during storage, preparation and testing. Second, they are brittle and crushable; they cannot withstand such treatment as traditional machining or launch in a gun system. Third, with increasing porosity the calculated Hugoniot density becomes rapidly more sensitive to errors in wave time-of-arrival measurements. Carefully chosen simulants eliminate preservation (friability) difficulties, but the other difficulties remain. A family of 36 impact tests was conducted on snow and snow simulants at Sandia, yielding reliable Hugoniot and reshock states, but limited release property information. Other methods for characterizing these materials are discussed.

28054 (SAND–94-0083C) **The influence of phase changes on debris-cloud interactions with protected structures.** Lawrence, R.J.; Kmetyk, L.N.; Chhabildas, L.C. Sandia National Labs., Albuquerque, NM (United States). 16 May 1994. 20p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. (CONF-9410131–1: 1994 hypervelocity impact symposium, Santa Fe, NM (United States), 16-20 Oct 1994). Order Number DE94014285. Source: OSTI; NTIS; GPO Dep.

HVIS Paper No. 143.

The physical state of the debris cloud generated by the interaction of a projectile with a thin target depends on the energy balance associated with above the sound speeds of the impact event. At impact velocities well materials involved, the cloud is expected to be primarily molten, but with some vapor present. A series of numerical calculations using the multi-dimensional finite-difference hydrocode CTH has been used to evaluate the effect of phase changes (i.e., different vapor fractions) on these clouds, and their subsequent interaction with backwall structures. In the calculations, higher concentrations of vapor are achieved by increasing the initial temperature of both the projectile and the thin shield while keeping the impact velocity constant, and by actually increasing the impact velocity. The nature of the debris cloud and its subsequent loading on the protected structure depend on both its thermal and physical state. This interaction can cause rupture, spallation or simply bulging of the backwall. These computational results are discussed and compared with new experimental observations obtained at an impact velocity of ~10 km/s. In the experiment, the debris cloud was generated by the impact of a plate-shaped titanium projectile with a thin titanium shield.

4210 Combustion Systems

Refer also to citation(s) 27221, 28007

4220 Mining and Underground Engineering

Refer also to citation(s) 27255

4260 Components, Electron Devices and Circuits

Refer also to citation(s) 27537, 27607, 27865, 27947, 27949, 27954, 28159, 28168, 28169, 28170, 28171, 28172, 28173, 28174, 28175, 28176, 28177, 28178, 28179, 28180, 28181, 28182, 28183, 28184, 28185, 28186, 28187, 28188, 28189, 28190, 28191, 28192, 28194, 28195, 28196, 28197, 28198, 28199, 28200, 28201, 28202, 28203, 28204, 28205, 28206, 28207, 28208, 28209, 28210, 28211, 28300, 28333, 28361, 28375, 28387, 28795, 28853, 28856

28055 (DOE/ER/54160–1-Vol.3, pp. 1709-1714) **Nonlinear simulation of a high-power collective free-electron laser.** Freund, H.P. (Naval Research Lab., Washington, DC (United States)); Ganguly, A.K. Maryland Univ., College Park, MD (United States). [1992]. (CONF-920515–Vol.3: 9. international conference on high power particle beams, Washington, DC (United States), 25-29 May 1992). In *Beams 92: Proceedings: Volume 3, Microwaves, Free electron lasers, Advanced accelerators, Applications, and Plasma discharges.* 681p. Order Number DE94014785. Source: OSTI; NTIS; INIS.

A comparison is described between the 3-D simulation code ARACHNE and a recent 33.4 GHz collective FEL amplifier experiment at MIT. The experiment demonstrated power levels of 61 MW (~ 27% efficiency) without recourse to tapered magnetic fields using a 750 keV/300 A electron beam with an axial energy spread of 1.5% propagating through a cylindrical drift tube in the presence of a helical wiggler [$B_w \leq 1.8$ kG, $\lambda_w = 3.18$ cm] and a guide magnetic field [$B_0 \leq 12$ kG]. The maximum power was observed when the wiggler and guide fields were antiparallel. ARACHNE is in substantial agreement with the experiment and shows peak power levels of 60 MW.

28056 (DOE/ER/54160–1-Vol.3, pp. 1715-1720) **Analysis of the electron dynamics in a Raman free electron laser with reversed axial guide magnetic field.** Spindler, G. (Institut fuer Technische Physik, Stuttgart (Germany)); Renz, G.; Conde, M.E.; Bekefi, G. Maryland Univ., College Park, MD (United States). [1992]. (CONF-920515–Vol.3: 9. international conference on high power particle beams, Washington, DC (United States), 25-29 May 1992). In *Beams 92: Proceedings: Volume 3, Microwaves, Free electron lasers, Advanced accelerators, Applications, and Plasma discharges.* 681p. Order Number DE94014785. Source: OSTI; NTIS; INIS.

Numerical simulations of the electron dynamics in a combined helical wiggler and reversed guide field arrangement, currently being under investigation at the MIT Plasma Fusion Center, are presented. The paper focuses on the unexpected breakdown of the FEL amplifier performance for a specific value of the reversed guide field, corresponding to the positive value at magnetoresonance. As an outgrowth, the theoretical possibility of higher harmonics generation in the presence of a reversed guide field is highlighted.

28057 (DOE/ER/54160–1-Vol.3, pp. 1721-1727) **Helical small period wiggler for the Raman free electron of SIOFM.** Ming Chang Wang (Shanghai Institute of Optics and Fine Mechanics (China)); Bibo Feng; Zhijiang Wang; Zaitong Lu; Lifen Zhang. Maryland Univ., College Park, MD (United States). [1992]. (CONF-920515–Vol.3: 9. international conference on high power particle beams, Washington, DC (United States), 25-29 May 1992). In *Beams 92: Proceedings: Volume 3, Microwaves, Free electron lasers, Advanced accelerators, Applications, and Plasma discharges.* 681p. Order Number DE94014785. Source: OSTI; NTIS; INIS.

The small period wigglers in recent years have been attracted by developing a compact free electron laser (FEL) device. A new small period wiggler configuration constructed by the bifilar helical sheets with ferro-magnetic cores for the Raman FEL of Shanghai Institute of Optics and Fine Mechanics (SIOFM) is developed, and the performance characteristics of the wiggler with 10 mm period and 600 mm length are measured. It is similar to the bifilar helical wires wiggler, but in this configuration, there are the copper sheets instead of the wires, some ferro-magnetic laminations between the copper sheets have been inserted in order to enhance the wiggler field. The field as high as 1500 G has been obtained with a large gap of 16 mm.

28058 (DOE/ER/54160–1-Vol.3, pp. 1728-1733) **Development of a high power millimeter wave free-electron laser amplifier.** Bidwell, S.W. (Univ. of Maryland, College Park, MD (United States)); Zhang, Z.X.; Antonsen, T.M. Jr.; Destler, W.W.; Granatstein, V.L.; Levush, B.; Rodgers, J.; Freund, H.P. Maryland Univ., College Park, MD (United States). [1992]. (CONF-920515–Vol.3: 9. international conference on high power particle beams, Washington, DC (United States), 25-29 May 1992). In *Beams 92: Proceedings: Volume 3, Microwaves, Free electron lasers, Advanced accelerators, Applications, and Plasma discharges.* 681p. Order Number DE94014785. Source: OSTI; NTIS; INIS.

Progress on the development of a high-average-power millimeter wave free-electron laser amplifier is reported. Successful sheet electron beam propagation has been observed through a 54 cm long wiggler magnet. One hundred percent transport efficiency is reported with a 15 A, 0.1 cm x 2.0 cm, sheet electron beam through $B_w = 5.1$ kG, $\lambda_w = 0.96$ cm, planar electromagnet wiggler. Preliminary success with a novel, yet simple, method of side focusing using offset poles is reported. Status of development on a 94 GHz, 180 kW, pulsed amplifier is discussed with results from numerical simulation.

28059 (DOE/ER/54160–1-Vol.3, pp. 1734-1739) **A kind of micro-FEL device with super-high gain.** Wu Ding (Institute of Applied Physics and Computational Mathematics, Beijing (China)).

Maryland Univ., College Park, MD (United States). [1992]. (CONF-920515–Vol.3: 9. international conference on high power particle beams, Washington, DC (United States), 25-29 May 1992). In *Beams 92: Proceedings: Volume 3, Microwaves, Free electron lasers, Advanced accelerators, Applications, and Plasma discharges.* 681p. Order Number DE94014785. Source: OSTI; NTIS; INIS.

In this paper the author has studied the gain characteristic of a FEL and found that there is a kind of micro-FEL device with super-high gain. This FEL device lies on the far infrared spectrum, it consists of a rf-linac and the electron beam of high brightness, a microwiggler and a capillary waveguide.

28060 (DOE/ER/54160–1-Vol.3, pp. 1740-1745) **Optical guiding and superradiance effects in free electron lasers.** Ginzburg, N.S. (Institute of Applied Physics, Novgorod (Russian Federation)). Maryland Univ., College Park, MD (United States). [1992]. (CONF-920515–Vol.3: 9. international conference on high power particle beams, Washington, DC (United States), 25-29 May 1992). In *Beams 92: Proceedings: Volume 3, Microwaves, Free electron lasers, Advanced accelerators, Applications, and Plasma discharges.* 681p. Order Number DE94014785. Source: OSTI; NTIS; INIS.

Efficiency enhancement in FEL under optical guiding condition and generation of short power electromagnetic pulse due to the superradiation processes are investigated.

28061 (DOE/ER/54160–1-Vol.3, pp. 1746-1751) **Nonlinear analysis of a grating free-electron laser.** Hafizi, B. (Icarus Research, Bethesda, MD (United States)); Serafim, P.; Sprangle, P.; Fisher, A. Maryland Univ., College Park, MD (United States). [1992]. (CONF-920515–Vol.3: 9. international conference on high power particle beams, Washington, DC (United States), 25-29 May 1992). In *Beams 92: Proceedings: Volume 3, Microwaves, Free electron lasers, Advanced accelerators, Applications, and Plasma discharges.* 681p. Order Number DE94014785. Source: OSTI; NTIS; INIS.

A nonlinear model of a grating free-electron laser is formulated that includes the effects of self-field forces, beam emittance, energy spread and gyromotion in a guide field. The authors compare the efficiency of an infinitely-thin beam, a finite-thickness beam with laminar flow and a finite-thickness beam with full transverse motion. For a thick beam, the effect of electron gyration about the beam axis is to enhance the efficiency as compared to that for a beam with laminar flow.

28062 (DOE/ER/54160–1-Vol.3, pp. 1752-1757) **Euphrosyne a pulsed electron generator for FEL application.** Bonnafond, C. (Centre d'Etudes Scientifiques et Techniques d'Aquitaine, Le Barp (France)); Bardy, J.; Bottollier-Curtet, H.; Devin, A.; Gardelle, J.; Germain, G.; Labrouche, J.; Launspach, J.; Le Taillandier, P.; Mascureau, J. de. Maryland Univ., College Park, MD (United States). [1992]. (CONF-920515–Vol.3: 9. international conference on high power particle beams, Washington, DC (United States), 25-29 May 1992). In *Beams 92: Proceedings: Volume 3, Microwaves, Free electron lasers, Advanced accelerators, Applications, and Plasma discharges.* 681p. Order Number DE94014785. Source: OSTI; NTIS; INIS.

At CESTA, the 35 GHz experiment ONDINE I is in progress. The studies focus on intense electron beam creation with the Euphrosyne generator and its propagation to the wiggler by means of a transmission line. The generator consists of a Marx generator, a pulse forming line and a diode using both thermionic and cold cathodes. The diode has been adapted to the forming line at 36 ohms in order to narrow the energetic spectrum. A full characterization of the beam has been achieved by measuring the position, the size with Cerenkov detectors, the energetic spectrum and the transverse emittance at different points of the transmission line. Calculations have been done by using envelope and particle codes to perform the propagation of the beam. Good agreement has been achieved. Typically, 1 kA at 1.5 MeV is obtained. In the frame of a preliminary superradiant experiment using a bifilar helical wiggler, the authors have measured an amplification of the spontaneous emission up to 1 MW in the Ka band and .2 MW in the 33-36 GHz band.

28063 (DOE/ER/54160–1-Vol.3, pp. 1758-1763) **FEL project for industrial applications in Japan.** Imasaki, K. (FEL Research Institute, Osaka (Japan)); Sato, S.; Miyauchi, Y.; Keishi, T.; Kobayashi, A.; Koga, A.; Nishimura, E.; Saeki, K.; Bessho, I.; Okano, M. Maryland Univ., College Park, MD (United States). [1992]. (CONF-920515–Vol.3: 9. international conference on high power particle beams, Washington, DC (United States), 25-29 May 1992). In *Beams 92: Proceedings: Volume 3, Microwaves, Free electron lasers, Advanced accelerators, Applications, and Plasma discharges.* 681p. Order Number DE94014785. Source: OSTI; NTIS; INIS.

FEL project for industrial application was started in Japan. The purpose of this project is to generate FEL from FIR to UV and use it to investigate industrial applications. FEL Engineering Corporation is founded to perform this project.

28064 (DOE/ER/54160–1-Vol.3, pp. 1764-1769) **A free electron laser at P.N. Lebedev Institute.** Maryland Univ., College Park, MD (United States). [1992]. (CONF-920515–Vol.3: 9. international conference on high power particle beams, Washington, DC (United States), 25-29 May 1992). In *Beams 92: Proceedings: Volume 3, Microwaves, Free electron lasers, Advanced accelerators, Applications, and Plasma discharges.* 681p. Order Number DE94014785. Source: OSTI; NTIS; INIS.

A free electron laser for IR spectroscopic research is now under construction on the basis of a specially designed RF linac. A goal of the project is obtaining IR radiation of 1 kW power in a 200 μs macropulse at wavelengths exceeding 10 μm. An approximately twofold tuning of the frequency can be achieved by varying the undulator field, while submillimeter wavelengths (up to 200 μm) can be obtained by increasing the undulator period and/or decreasing the electron energy.

28065 (DOE/ER/54160–1-Vol.3, pp. 1770-1775) **Free-electron laser-FEL-based on MSU RM-100 race-track microtron.** Grishin, V.K. (Moscow State Univ. (Russian Federation)); Ishkhanov, B.S.; Sandalov, A.N.; Shvedunov, V.I. Maryland Univ., College Park, MD (United States). [1992]. (CONF-920515–Vol.3: 9. international conference on high power particle beams, Washington, DC (United States), 25-29 May 1992). In *Beams 92: Proceedings: Volume 3, Microwaves, Free electron lasers, Advanced accelerators, Applications, and Plasma discharges.* 681p. Order Number DE94014785. Source: OSTI; NTIS; INIS.

The race-track microtron RM-100 MSU, the first stage of which has recently come into operation, is designed to accelerate electrons with variable energy of 7-180 MeV at a high quality of the beam: the homogeneity of energy is 10^{-4}, the beam emittance is not higher than 0.01 mm×mrad. The beam current is a contisequence of electron pulses with duration of 3-4 ps, repetition frequency of 2.45 GHz and the average current of 100 mA. A special operation mode of the acceleration is provided with duty cycle decreased by 100-300 times and the amplitude of current pulses increased up to 1 - 10 A.

28066 (DOE/ER/54160–1-Vol.3, pp. 1776-1780) **High current cerencov free electron laser-CFEL at far infrared wavelengths.** Grishin, V.K. (Moscow State Univ. (Russian Federation)); Cricket, C.M.; Lenski, I.F. Maryland Univ., College Park, MD (United States). [1992]. (CONF-920515–Vol.3: 9. international conference on high power particle beams, Washington, DC (United States), 25-29 May 1992). In *Beams 92: Proceedings: Volume 3, Microwaves, Free electron lasers, Advanced accelerators, Applications, and Plasma discharges.* 681p. Order Number DE94014785. Source: OSTI; NTIS; INIS.

At present the so-called cerencov free electron laser - CFEL - is given much experimental and theoretical attention. In CFEL the electron beam propagates near the dielectric surface and excites a slow electromagnetic wave with the phase velocity that is somewhat less than the beam's velocity: $v_{ph}=\beta_{ph}c=\omega/kc$; $v_0=\beta_0 c$, where v_0 is the beam velocity, and transfers its kinetic energy to the radiation. CFEL-systems with dielectric layers are structurally sufficiently simple and are promising devices for excitation of electromagnetic radiation at millimeter and submillimeter wavelengths with smooth tuning by means of varying the electron energy. Of course now one considers using low-energy relativistic electron beams, since the

radiation wavelength increases very rapidly with the growing energy of a relativistic beam. The authors discuss the efficiency of a modified version of this scheme including elements of gas plasma.

28067 (DOE/ER/54160–1-Vol.3, pp. 1861-1866) **The LELIA induction injector: First results.** Bardy, J. (Centre d'Etudes Scientifiques et Techniques d'Aquitaine, Barp (France)); Anthouard, P.; Eyharts, P.; Eyl, P.; Thevenot, M.; Roques, A.; Villate, D. Maryland Univ., College Park, MD (United States). [1992]. (CONF-920515–Vol.3: 9. international conference on high power particle beams, Washington, DC (United States), 25-29 May 1992). In *Beams 92: Proceedings: Volume 3, Microwaves, Free electron lasers, Advanced accelerators, Applications, and Plasma discharges.* 681p. Order Number DE94014785. Source: OSTI; NTIS; INIS.

LELIA is an induction accelerator designed and built at CESTA for FEL applications. The objective of this program is to produce a high-brightness and high-average-power electron beam. An injector (1.5 MeV, 1.5 kA, 50 ns flat top pulse) is now under test. It uses an Osmium dispenser cathode and ten induction cells driven by a high voltage pulse generator (150 kV, 60 ns, 2 Ω). It is able to work at high repetition rate (1 KHz). Initial operation began in June last year. Beam characteristics have ben measured and compared with numerical simulations.

28068 (DOE/ER/54160–1-Vol.3, pp. 1876-1880) **A 3.4 MeV linear induction accelerator.** Cheng Nianan (China Academy of Engineering Physics, Sichuan (China)); Zhang Shouyun; Tao Zucong. Maryland Univ., College Park, MD (United States). [1992]. (CONF-920515–Vol.3: 9. international conference on high power particle beams, Washington, DC (United States), 25-29 May 1992). In *Beams 92: Proceedings: Volume 3, Microwaves, Free electron lasers, Advanced accelerators, Applications, and Plasma discharges.* 681p. Order Number DE94014785. Source: OSTI; NTIS; INIS.

A 3.4 MeV linear induction accelerator has been built for use in free electron laser (FEL) research. This machine consists of a 1 MeV injector followed by eight accelerating induction cells. Each accelerating cell adds 300 kV to the electron beam. Electron beam with the brightness of 2.0×10^8 A/(m-rad)^2 has been produced. The beam current is 2.0 kA and its radius is 2.0 cm. The beam pulse length is 90 ns. The experiments of the self amplified spontaneous emission free electron laser (SASE-FEL) are being performed.

28069 (DOE/ER/54160–1-Vol.3, pp. 1912-1917) **Large area electron beam generation and propagation for KrF lasers.** Pawley, C.J. (Naval Research Lab., Washington, DC (United States)); Sethian, J.D.; Obenschain, S.P.; Czuchlewski, S.J. Maryland Univ., College Park, MD (United States). [1992]. (CONF-920515–Vol.3: 9. international conference on high power particle beams, Washington, DC (United States), 25-29 May 1992). In *Beams 92: Proceedings: Volume 3, Microwaves, Free electron lasers, Advanced accelerators, Applications, and Plasma discharges.* 681p. Order Number DE94014785. Source: OSTI; NTIS; INIS.

High energy KrF lasers have optical output apertures ranging from 10x10 cm^2 to 1x1 m^2. The electron beam must uniformly pump the entire aperture and the length of the laser amplifier. These electron beams are usually mildly relativistic (250 - 750 keV) and have moderate current densities (10 - 100 amps/cm^2). The NIKE system at NRL incorporates a 20x20 cm^2 aperture laser amplifier to drive a 60x60 cm^2 aperture final amplifier expected to deliver greater than 4 kJ of laser output. Design considerations, testing, and experimental data from the 20 cm amplifier are presented as well as an overview of some of the models used to understand the results. Particular attention is paid to obtaining a uniform electron beam with minimal small scale structure. Results of the electron beam uniformity and improved electron transmission efficiency to the gas for the 20 cm amplifier will be presented. The design of the 60 cm amplifier being constructed will also be presented.

28070 (DOE/ER/54160–1-Vol.3, pp. 1918-1923) **Development of a 100 joule level XeCl laser pumped by intense relativistic electron beam.** Liu, J.R.; Sun, R.F.; Qiu, A.C.; Yuan, X.; Gan, Y.G.; Wang, X.H.; Zhang, Y.M.; Zhao, X.Q.; Ren, S.Q.; Nie, L. Maryland Univ., College Park, MD (United States). [1992]. (CONF-920515–Vol.3: 9. international conference on high power particle beams, Washington, DC (United States), 25-29 May 1992). In *Beams 92: Proceedings: Volume 3, Microwaves, Free electron lasers, Advanced accelerators, Applications, and Plasma discharges.* 681p. Order Number DE94014785. Source: OSTI; NTIS; INIS.

A 100 J level XeCl laser pumped by an intense relativistic electron beam - FLASH II was constructed at Northwest Institute of Nuclear Technology in China. It consists of a 64 stage Marx generator, pulse forming line, field-distortion main switch, pulse transmission line, output line and diode. The cathode of diode for laser pumping is a 15 x 60 cm long multi-point copper plate or graphite plane plate. The anode and pressure foils are both 25 micron Ti. The voltage of diode is measured to be 650-750 kV and the current 290-350 kA. The pump power density ranges between 1.5-2.0 MW/cm^3. The aperture of laser cell is 20 x 20 cm and the effective excitation volume is 24 liters. The authors have obtained the laser output energy of 136 J with a parallel-plane resonator and 1.5 mrad divergence angle from an unstable resonator. The laser power is measured to be more than 10^9 W.

28071 (DOE/ER/54160–1-Vol.3, pp. 2014-2019) **High power imploding plasma for the X-ray laser.** Baksht, R.B. (High Current Electronics Institute, Tomsk (Russian Federation)); Datsko, I.M.; Kokshenev, V.A.; Kim, A.A.; Luchinski, A.V.; Loskutov, V.V.; Oreshkin, V.I.; Russkich, A.G. Maryland Univ., College Park, MD (United States). [1992]. (CONF-920515–Vol.3: 9. international conference on high power particle beams, Washington, DC (United States), 25-29 May 1992). In *Beams 92: Proceedings: Volume 3, Microwaves, Free electron lasers, Advanced accelerators, Applications, and Plasma discharges.* 681p. Order Number DE94014785. Source: OSTI; NTIS; INIS.

The Al-Mg photoresonant X-ray laser scheme is investigated using collisional radiative model. It is shown that monochromatic pump powers of 10^9 Wt are obtainable within the 48 A Al pump line. Experiments on Al-wire array implosion were carried out on the 1.2-1.5 MA GI-4 generator with a 1 cm separation between the plasma and the current return posts. The experimental output power in the region of $\lambda = 48$ Å made up $(1\text{-}2)\cdot10^9$ Wt/cm. The main K- and L-shell radiation yields from bright spots distributed 2-3 per cm. A simulation with the help of the collisional radiative model has demonstrated that the plasma temperature and density are 200 eV and 10^{20} cm^{-3}, respectively. Two schemes of the creating of the pumped plasma were suggested.

28072 (DOE/FTR–94009531) **Joint DOE/DOD Lasers & Optics Working Group trip to the Russian Federation: Foreign trip report, January 29, 1994–February 12, 1994.** Partin, J.K. EG and G Idaho, Inc., Idaho Falls, ID (United States). 5 Apr 1994. 23p. Sponsored by USDOE, Washington, DC (United States);Department of Defense, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE94009531. Source: OSTI; NTIS (US Sales Only); GPO Dep.

From January 29, 1994 to February 12 1994, traveled as a technical advisor with a delegation composed of members from the Department of Energy (DOE) and the Department of Defense (DOD) to the Russian Federation cities of Moscow, Nizhny-Novgorod and St. Petersburg. The delegation included members from DOE Headquarters, Idaho National Engineering Laboratory, Los Alamos National Laboratory, Air Force Phillips Laboratory, Air Force Material Command, Air Force Space Command and Battelle Memorial. The trip was a continuation of an effort initiated in 1993 to identify and obtain Russian technology in the areas of lasers and optical sensing. As a result of a previous delegation's trip (June 19–July 3, 1993), several Russian institutes were selected to develop a workscope for the conceptual design of a space debris detection, identification and tracking system. The goals of the trip were: to review the results of a contract on "Weak Signal Amplification of Reflected Light from Space Debris" completed by PASSAT Enterprise in Nizhny Novgorod and discuss possible follow-on work in the area of remote sensing. Discuss and outline the technical work scope and deliverables of space-debris tracking systems with Laser Systems, Inc. and Astrophysica in Moscow and

the Vavilov State Optical Institute in St. Petersburg. Discuss Russian concepts and proposals for applying nonlinear optical techniques for enhancing remote sensing systems and to identify other areas for potential collaboration. A listing of the team members, their affiliations and duties are included in the Appendix, along with a detailed itinerary and the key contacts.

28073 (FNAL-TM–1871) **An assessment of alternatives for replacing Freon 113 in bench type electrical circuit board cleaning at Fermi National Accelerator Laboratory.** Isakson, K.; Vessell, A.L. Fermi National Accelerator Lab., Batavia, IL (United States). Jul 1994. 49p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH03000. Order Number DE94015850. Source: OSTI; NTIS; INIS; GPO Dep.

Fermilab is presently phasing out all solvents containing Freon-113 (CFC-113) as part of the continuing Waste Minimization Program. These solvents are used primarily in cleaning the flux off of electronic circuit boards after soldering, specifically in bench type work. Title VI of the Clean Air Act mandates a production phase-out for ozone depleting substances, like CFC-113, by the year 2000. Our study addresses this issue by evaluating and choosing alternative non-CFC solvents to replace the CFC-1 13 solvents at Fermilab. Several potential non-CFC cleaning solvents were tested. The evaluation took place in three parts: controlled experimental evaluation, chemical composition evaluation, and employee performed evaluation. First, we performed a controlled nine-step procedure with the potential solvents where each was evaluated in categories such as cleaning effectiveness, odor, residue, type of output and drying time. Next, we listed the chemical composition of each solvent. We noted which solvents contained hydrochlorofluorocarbons because they are targeted for phase-out in the future and will be recognized as interim solutions only. Finally, after preliminary testing, five solvents were chosen as the best options. These solvents were sent to be tested by Fermilab employees who use such materials. Their opinions are valuable not only because they are knowledgeable in this field, but also because they will be using the solvents chosen to replace the CFC-113 solvents. The results favored two "best alternatives": Safezone Solvent Flux Remover by Miller-Stephenson and E-Series CFC Free Flux-Off 2000 by Chemtech. Another possible solution also pursued is the no-clean solder option. In our study, we were not able to thoroughly investigate the many types of no-clean solders because of time and financial constraints. The testing that was done, however, showed that no-clean solder was a viable alternative in many cases.

28074 (KCP–613-5273) **Aging of D-limonene-cleaned assemblies.** Somer, T.A. Allied-Signal Aerospace Co., Kansas City, MO (United States). Kansas City Div. Apr 1994. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00613. Order Number DE94015862. Source: OSTI; NTIS; GPO Dep.

The performance of 2000 electronic circuit variables was monitored throughout a 5000-hour exposure to + 160°F. the 2000 variables involve 36 electronic assemblies, cleaned with various solvents, including d-limonene, as a replacement for TCE. The assemblies were divided into four groups, including a TCE-cleaned control group at room temperature. Of the three groups exposed at + 160°F, one was cleaned in TCE, one was cleaned in d-limonene, and one was kept in a saturated d-limonene atmosphere. No performance degradation was observed with any of the groups, including the worst case exposure in a saturated d-limonene atmosphere.

28075 (KCP–613-5318) **Antenna dielectric sealing process characterization: Final report.** Busby, M.L.; Yerganian, S.S. Allied-Signal Aerospace Co., Kansas City, MO (United States). Kansas City Div. Apr 1994. 79p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00613. Order Number DE94015864. Source: OSTI; NTIS; GPO Dep.

An antenna assembly experienced leak test failures during TMS testing. The leaks were occurring between the dielectric and housing. The antenna assembly dielectric is sealed into a nickel-plated aluminum housing using a tin catalyzed condensation cure silicone (RTV). In preparation for sealing, the dielectric and housing are chemically cleaned and then plasma cleaned. The surfaces to be sealed are primed, RTV is applied, and the RTV is cured in a humidity chamber. This report is an evaluation of the production process and includes FEM analysis and process characterization and control (PC&C) data.

28076 (LA-UR–94-2576) **The US 100 T magnet project.** Campbell, L.J. (Los Alamos National Lab., NM (United States)); Parkin, D.M.; Rickel, D.G.; Schillig, J.B.; Eyssa, Y.; Gilmore, P.; Pernambuco-Wise, P.; Schneider-Muntau, H.J. Los Alamos National Lab., NM (United States). [1994]. 11p. Sponsored by USDOE, Washington, DC (United States);National Science Foundation, Washington, DC (United States). DOE Contract W-7405-ENG-36. Grant DMR 9016241. (CONF-940831–1: 4. international symposium on research in high magnetic fields, Nijmegen (Netherlands), 29-31 Aug 1994). Order Number DE94016099. Source: OSTI; NTIS; GPO Dep.

A design is presented of a 100 T research magnet to generate high field pulses having lengths of more than 20 ms at field levels of above 80 T. The magnet is designed to be non-destructive, have a bore of 24 mm and a repetition rate of less than one hour. It consists of a 50 T outsert magnet, constructed of five concentric, mechanically independent coils, powered from a motor-generator, and a self-supporting 50 T insert magnet, which is energized from a capacitor bank. The design is based on commercially available materials. The magnet has an overall diameter and total length of approximately 1 m.

28077 **Semiconductor diode laser having an intracavity spatial phase controller for beam control and switching.** Hohimer, J.P. To Dept. of Energy. 1992. Filed date 14 May 1992. U.S. Patent Application 7-883,315. 29p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. Order Number DE94014899. Source: OSTI; NTIS; GPO Dep.

A high-power broad-area semiconductor laser having a intracavity spatial phase controller is disclosed. The integrated intracavity spatial phase controller is easily formed by patterning an electrical contact metallization layer when fabricating the semiconductor laser. This spatial phase controller changes the normally broad far-field emission bean, of such a laser into a single-lobed near-diffraction-limited beam at pulsed output powers of over 400 mW. Two operating modes, a thermal and a gain operating mode, exist for the phase controller, allowing for steering and switching the beam as the modes of operation are switched, and the emission beam may be scanned, for example, over a range of 1.4 degrees or switched by 8 degrees. More than one spatial phase controller may be integrated into the laser structure.

28078 **Compact self-contained electrical-to-optical converter/transmitter.** Seligmann, D.A.; Moss, W.C.; Valk, T.C.; Conder, A.D. To Dept. of Energy. 1992. Filed date 24 Aug 1992. U.S. Patent Application 7-933,642. 26p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. Order Number DE94016116. Source: OSTI; NTIS; GPO Dep.

An electrical-to-optical converter/transmitter is disclosed. A first optical receiver and a second optical receiver are provided for receiving a calibrate command and a power switching signal, respectively, from a remote processor. A third receiver is provided for receiving an analog electrical signal from a transducer. A calibrator generates a reference signal in response to the calibrate command. A combiner mixes the electrical signal with the reference signal to form a calibrated signal. A converter converts the calibrated signal to an optical signal. A transmitter transmits the optical signal to the remote processor. A primary battery supplies power to the calibrator, the combiner, the converter, and the transmitter. An optically-activated switch supplies power to the calibrator, the combiner, the converter, and the transmitter in response to the power switching signal. An auxiliary battery supplies power continuously to the switch means.

28079 **Laser patterning of laminated structures for electroplating.** Mayer, S.T.; Evans, L.B. To Dept. of Energy. 1992. Filed date 8 Sep 1992. U.S. Patent Application 7-941,838. 17p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. Order Number DE94016102. Source: OSTI; NTIS; GPO Dep.

Disclosed is a process for laser patterning of a substrate so that it can be subsequently electroplated or electrolessly plated. The process utilizes a laser to treat an inactive (inert) layer formed over

an active layer to either combine or remove the inactive layer to produce a patterned active layer on which electrodeposition can occur. The process is carried out by utilizing laser alloying and laser etching, and involves only a few relatively high yield steps and can be performed on a very small scale.

28080 (SAND–93-2243C) **High gain GaAs switches for impulse sources: Measurement of the speed of current filaments.** Loubriel, G.M.; Zutavern, F.J.; O'Maliey, M.W.; Gallegos, R.R.; Helgeson, W.D.; Hjalmarson, H.P.; Baca, A.G.; Plut, T.A. Sandia National Labs., Albuquerque, NM (United States). [1994]. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. (CONF-940678–4: 21. international power modulator symposium, Costa Mesa, CA (United States), 28-30 Jun 1994). Order Number DE94015281. Source: OSTI; NTIS; GPO Dep.

A high peak power impulse pulser that is controlled with high gain, optically triggered GaAs Photoconductive Semiconductor Switches (PCSS) has been constructed and tested. The system has a short 50 ohm line that is charged to 100 kV and discharged through the switch when the switch is triggered with as little as 90 nJ of laser energy. The authors have demonstrated that the GaAs switches can be used to produce either a monocycle or a monopulse with a period of total duration of about 3 ns. For the monopulse, the voltage switched was above 100 kV, producing a peak power of about 48 MW to the 30 ohm load at a burst repetition rate of 1 kHz. The laser that is used is a small laser diode array whose output is delivered through a fiber to the switch. The current in the system has rise times of 430 ps and a pulse width of 1.4 ns when two laser diode arrays are used to trigger the switch. The small trigger energy and switch jitter are due to a high gain switching mechanism in GaAs. This experiment also shows a relationship between the rise time of the voltage across the switch and the required trigger energy and switch jitter. The time evolution of the current filaments in an optically triggered, high gain GaAs switch was studied by recording the infrared photoluminescence from the filaments. When the system is triggered with two laser diode arrays that are activated within 1 ns of each other, two current filaments are observed. By delaying one laser with respect to the other, the evolution of the filament was recorded in a time resolved fashion. The filament that is triggered first crosses the switch, the voltage drops and the other filament ceases to grow. By varying the delay between the trigger lasers, the tip velocity is measured to be up to $5.9 \pm 1 \times 10^9$ cm/s.

28081 (SAND–94-0391) **Time-of-flight detector for heavy ion backscattering spectrometry.** Knapp, J.A. (Sandia National Labs., Albuquerque, NM (United States). Ion Solid Interactions and Defect Physics Dept.); Banks, J.C.; Doyle, B.L. Sandia National Labs., Albuquerque, NM (United States). Apr 1994. 12p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. Order Number DE94015600. Source: OSTI; NTIS; GPO Dep.

This report describes the results of a two-year laboratory directed research and development project to explore advanced concepts in Heavy Ion Backscattering Spectrometry (HIBS), undertaken with the goal of extending the sensitivity of this relatively new technique to levels unattainable by any other existing trace element surface analysis. Improvements in sensitivity are required for the application of HIBS to contamination control in the microelectronics industry. Tools with sensitivity approaching 10^8 atoms/cm^2 are expected to be essential for enabling advanced IC production by the year 2000. During the project the authors developed a new analysis chamber with channeling goniometer and a prototype time-of-flight detector with a demonstrated sensitivity of $\sim 5 \times 10^8$ atoms/cm^2 for Au on Si and $\sim 5 \times 10^{10}$ for Fe, and sufficient mass resolution to separate contributions from Fe and Cu.

28082 (SAND–94-1227C) **Influence of electrode geometry on the high-field characteristics of photoconductive silicon wafers.** Madangarli, V.P. (South Carolina Univ., Columbia, SC (United States). Dept. of Electrical and Computer Engineering); Gradinaru, G.; Korony, G.; Sudarshan, T.S.; Loubriel, G.M.; Zutavern, F.J.; Patterson, P.E. Sandia National Labs., Albuquerque, NM (United States). [1994]. 13p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. (CONF-940678–2: 21. international power modulator symposium, Costa Mesa, CA (United States), 28-30 Jun 1994). Order Number DE94014660. Source: OSTI; NTIS; GPO Dep.

A series of experiment were conducted to study the influence of electrode geometry on the prebreakdown (and breakdown) characteristics of high resistivity ($\rho > 30$ kΩ-cm), p-type Si wafers under quasi-uniform and non-uniform electric field configurations. In the quasi-uniform field configuration, the 1mm thick Si wafer was mounted between the slots of two plane parallel stainless steel disc electrodes (parallel), while the non-uniform field was obtained by mounting the wafer between two pillar-type electrodes with a hemispherical tip (pillar). The main objective of the above investigation was to verify if the uniform field configuration under a parallel system has a positive influence by reducing the field enhancement at the contact region, as opposed to the definite field enhancement present in the case of the non-uniform pillar system. Also, it was proposed to study the effect of the contact profile on the field distribution over the wafer surface and hence its influence on the high-field performance of the Si wafers.

28083 (SAND–94-1316C) **I_{DDQ} testing for ultimate low power design verification and defect detection.** Hawkins, C.F. (New Mexico Univ., Albuquerque, NM (United States). Dept. of Electrical and Computer Engineering); Hewlett, F.W.; Soden, J.M. Sandia National Labs., Albuquerque, NM (United States). [1994]. 3p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. (CONF-941087–1: Symposium on low-power electronics, San Diego, CA (United States), 10-12 Oct 1994). Order Number DE94014281. Source: OSTI; NTIS; GPO Dep.

I_{DDQ} testing is mandatory to ensure that low power CMOS ICs meet their design intent. I_{DDQ} testing is both a design verifier for low quiescent current and a sensitive production test for defects. Quiescent power reduction is particularly important for products such as cardiac pacemakers, laptop computers, and cellular telephones.

28084 (SAND–94-1381C) **The effects of spatial location of defect states on the switching characteristics of amorphous and polycrystalline silicon thin film transistors: A numerical simulation using AMPS 2-D.** Smith, J. (Sandia National Labs., Albuquerque, NM (United States)); Fonash, S.; Kalkan, A. Sandia National Labs., Albuquerque, NM (United States). [1994]. 4p. Sponsored by USDOE, Washington, DC (United States);Department of Defense, Washington, DC (United States);Electric Power Research Inst., Palo Alto, CA (United States). DOE Contract AC04-94AL85000. (CONF-9410116–1: 1994 international display research conference, Monterey, CA (United States), 10-13 Oct 1994). Order Number DE94013437. Source: OSTI; NTIS; GPO Dep.

We demonstrate a two-dimensional device simulator for MOSFET structures that incorporates models for defect distributions and show predicted effects on device switching performance for various spatial distributions of defects in amorphous and polycrystalline silicon.

28085 (SAND–94-1436C) **Tunable UV source for UV fluorescence remote sensing.** Mead, R.D. (Aculight Corp., Bellevue, WA (United States)); Lowenthal, D.D.; Raymond, T.D.; Alford, W.J.; Smith, A.V.; Johnson, M.S. Sandia National Labs., Albuquerque, NM (United States). [1994]. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. (CONF-9404162–9: 1994 caliope interim technical review, Oakland, CA (United States), 26-28 Apr 1994). Order Number DE94015745. Source: OSTI; NTIS; GPO Dep.

Efficient generation of ultraviolet radiation tunable over the 240–410 nm range has been achieved in a system suitable for ultraviolet (uv) fluorescence remote sensing. Light from an Optical Parametric Oscillator/Amplifier turning in the 0.7–2.1 μm range is mixed with the second or third harmonic from a Nd:YAG laser, to obtain up to 30 mJ of broadly tunable output in the ultraviolet.

28086 (SAND–94-1496C) **Evaluation of the SC-1/megasonic clean for sub-0.15 micron particle removal.** Adkins, C.L.J.; Resnick, P.J.; Clews, P.J.; Thomas, E.V.; Korbe, N.C.; Cannaday, S.T. Sandia National Labs., Albuquerque, NM (United States).

[1994]. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. (CONF-9410134–1: Brittle fracture safety assessment, Krefeld (Germany), Oct 1994). Order Number DE94014282. Source: OSTI; NTIS; GPO Dep.

A statistical design of experiments approach has been employed to evaluate the particle removal efficacy of the SC-1/megasonic clean for sub-0.15 μm inorganic particles. The effects of megasonic input power, solution chemistry, bath temperature, and immersion time have been investigated. Immersion time was not observed to be a statistically significant factor. The NH_4OH/H_2O_2 ratio was significant, but varying the molar H_2O_2 concentration had no effect on inorganic particle removal. Substantially diluted chemistries, performed with high megasonic input power and moderate-to-elevated temperatures, was shown to be very effective for small particle removal. Bath composition data show extended lifetimes can be obtained when high purity chemicals are used at moderate (eg., 45°C) temperature. Transition metal surface concentrations and surface roughness have been measured after dilute SC-1 processing and compared to metallic contamination following traditional SC-1.

28087 (SAND–94-1503C) **Cut-off-mesa isolated rib optial waveguide for 3–5 heterostructure PICs.** Vawter, G.A.; Smith, R.E. Sandia National Labs., Albuquerque, NM (United States). [1994]. 3p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. (CONF-941006–1: Annual conference of the Optical Society of America and exhibit, Boston, MA (United States), 30 Oct - 4 nov 1994). Order Number DE94014661. Source: OSTI; NTIS; GPO Dep.

A new waveguide is designed using a cut-off slab waveguide for fabrication of single-mode rib optical waveguides with mesa isolation. These waveguides are easy to fabricate and offer crosstalk performance perhaps better than BH waveguides.

28088 (SAND–94-1700C) **Evaluation of overflow wet rinsing efficiency.** Kempka, S.N. (Sandia National Labs., Albuquerque, NM (United States)); Torczynski, J.R.; Geller, A.S.; Rosato, J.J.; Walters, R.N.; Sibbett, S.S. Sandia National Labs., Albuquerque, NM (United States). [1994]. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. (CONF-9410132–3: Microcontamination '94, San Jose, CA (United States), 5-6 Oct 1994). Order Number DE94015019. Source: OSTI; NTIS; GPO Dep.

A description of the flow field in an overflow wafer rinse process is presented. This information is being used in an initiative whose principal objective is to reduce the usage of water in wafer rinsing. The velocity field is calculated using finite-element numerical techniques. A large portion of the water does not contribute to wafer rinsing.

28089 (SAND–94-1782C) **A compact high voltage pulse generator.** Rohwein, G.J.; Babcock, S.R. Sandia National Labs., Albuquerque, NM (United States). [1994]. 3p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. (CONF-9407102–1: 21. international power modulator symposium, Costa Mesa, CA (United States), 27-30 Jul 1994). Order Number DE94015282. Source: OSTI; NTIS; GPO Dep.

A compact, easily transportable, pulse generator has been developed for a variety of applications that require a pulse duration in the range of 1 μ sec., voltages from 150 to 300 KV and current levels from 2,000 to 3,000 amps. The generator has a simple cylindrical configuration and modular construction to facilitate assembly and service. The generator may be operated single-pulse or repetitively at pulse repetition rates to 50 Hz in a burst mode.

28090 (SAND–94-1825C) **A new manufacturing method for the formation of gated field emission structures.** Fleming, J.G.; Walko, R.; King, D. Sandia National Labs., Albuquerque, NM (United States). [1994]. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. (CONF-9407101–1: 7. international vacuum microelectronics conference, Grenoble (France), 7 Jul 1994). Order Number DE94015287. Source: OSTI; NTIS; GPO Dep.

Functioning, matrixed, field emission devices have been fabricated using a modification of standard integrated circuit fabrication techniques. The emitter-to-gate spacing is fixed by the thickness of a deposited oxide and not by photolithographic techniques. Modeling of the emitted electron trajectories using a two dimensional, Poisson solver, finite difference code indicates that much of the current runs perpendicular to plane of the part. Functioning triode structures have been fabricated using this approach. Emission current, to a collector electrically and physically separated from the matrixed array follows Fowler-Nordheim behavior.

28091 (SAND–94-1888C) **Magnetic field dependent photoluminescence studies of InGaAs/GaAs strained-single-quantum wells.** Jones, E.D. (Sandia National Labs., Albuquerque, NM (United States)); Dawson, L.R.; Klem, J.F.; Lyo, S.K.; Heiman, D.; Liu, X.C. Sandia National Labs., Albuquerque, NM (United States). [1994]. 4p. Sponsored by USDOE, Washington, DC (United States);National Science Foundation, Washington, DC (United States). DOE Contract AC04-94AL85000. Grant DMR-9201614. (CONF-940847–2: Conference on the application of high magnetic fields, Cambridge, MA (United States), 8-12 Aug 1994). Order Number DE94015774. Source: OSTI; NTIS; GPO Dep.

Magnetoluminescence determined conduction-band and valence-band dispersion curves are presented for n-type InGaAs/GaAs stained-single-quantum well structures. The magnetic field range was 0 to 30 tesla, and the temperature varied between 4.2 and 77.4 K.

28092 (SAND–94-1956C) **A method for reducing encapsulation stress to ferrite pot cores.** Sanchez, R.O. Sandia National Labs., Albuquerque, NM (United States). [1994]. 15p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. (CONF-9409166–2: Electrical manufacturing and coil winding conference, Chicago, IL (United States), 27 Sep 1994). Order Number DE94015895. Source: OSTI; NTIS; GPO Dep.

This paper describes a method of reducing the mechanical stress caused when a ferrite pot core is encapsulated in a rigid epoxy. the stresses are due to the differences of coefficient of thermal expansion between the two materials. A stress relief medium, phenolic micro-balloon-filled, syntactic polysulfide, is molded into the shape of the pot core. The molded polysulfide is bonded to the core prior to encapsulation. The new package design has made a significant difference in the ability to survive temperature cycles.

28093 (SAND–94-8713C) **The influence of wavelength-dependent radiation in simulation of lamp-heated rapid thermal processing systems.** Ting, A. (Sandia National Labs., Livermore, CA (United States). Computational Mechanics Dept.). Sandia National Labs., Livermore, CA (United States). [1994]. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DR00789. (CONF-9408122–1: 2. international rapid thermal processing conference, Monterey, CA (United States), 13 Aug - 2 sep 1994). Order Number DE94015716. Source: OSTI; NTIS; GPO Dep.

Understanding the thermal response of lamp-heated rapid thermal processing (RTP) systems requires understanding relatively complex radiation exchange among opaque and partially transmitting surfaces and materials. The objective of this paper is to investigate the influence of wavelength-dependent radiative properties. The examples used for the analysis consider axisymmetric systems of the kind that were developed by Texas Instruments (TI) for the Microelectronics Manufacturing Science and Technology (MMST) Program and illustrate a number of wavelength-dependent (spectral) effects. The models execute quickly on workstation class computing flatforms, and thus permit rapid comparison of alternative reactor designs and physical models. The fast execution may also permit the incorporation of these models into real-time model-based process control algorithms.

28094 (UCRL-ID–117079) **A high average power electro-optic switch using KTP.** Ebbers, C.A.; Cook, W.M.; Velsko, S.P. Lawrence Livermore National Lab., CA (United States). Apr 1994. 22p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. Order Number DE94016416. Source: OSTI; NTIS; GPO Dep.

High damage threshold, high thermal conductivity, and small thermo-optic coefficients make $KTiOPO_4$ (KTP) an attractive material for use in a high average power Q-switch. However, electro-chromic damage and refractive index homogeneity have

prevented the utilization of KTP in such a device in the past. This work shows that electro-chromic damage is effectively suppressed using capacitive coupling, and a KTP crystal can be Q-switched for 1.5×10^9 shots without any detectable electro-chromic damage. In addition, KTP with the high uniformity and large aperture size needed for a KTP electro-optic Q-switch can be obtained from flux crystals grown at constant temperature. A thermally compensated, dual crystal KTP Q-switch, which successfully produced 50 mJ pulses with a pulse width of 8 ns (FWHM), has been constructed. In addition, in off-line testing the Q-switch showed less than 7% depolarization at an average power loading of 3.2 kW/cm^2.

28095 (UCRL-ID–117785) **High power phase conjugated solid state lasers.** Hackel, L.A.; Dane, C.B.; Zapata, L.E.; Hermann, M.R. Lawrence Livermore National Lab., CA (United States). Jul 1994. 46p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. Order Number DE94016633. Source: OSTI; NTIS; GPO Dep.

Three laser systems that are being developed for use in x-ray generation which incorporate SBS phase conjugate mirrors are described. A 25J/pulse Nd:glass laser is being developed for commercial proximity print x-ray lithography; a 0.5J/pulse, 1.3 kHz pulse repetition frequency laser is being built for soft x-ray projection lithography; and a 1 kJ/pulse laser driver for a table top x-ray laser has been designed. The results of prototypical experimental investigations are presented and the basic design principles for high average power phase conjugated laser systems shared by each of these lasers are discussed.

28096 (UCRL-JC–114954) **Beam characteristics of a large-bore copper laser with a radiatively cooled plasma.** Chang, J.J. (Lawrence Livermore National Lab., CA (United States)); Boley, C.D.; Molander, W.A.; Warner, B.E.; Martinez, M.W. Lawrence Livermore National Lab., CA (United States). 18 Jan 1994. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-940142–42: OE/LASE '94: conference on optics, electro-optics, and laser applications in science and engineering, Los Angeles, CA (United States), 22-29 Jan 1994). Order Number DE94015139. Source: OSTI; NTIS; GPO Dep.

In a large-bore copper vapor laser (CVL), excessive gas heating at the axial region of the discharge lowers its efficiency by thermally populating the metastable lower laser levels. The associated lower gas density also lengthens the discharge field-diffusion time, leading to weaker axial pumping and undesired beam characteristics. The authors' laboratory has developed a novel approach to circumvent this obstacle by cooling the plasma radiatively via a series of segmented metal plates (septa) placed vertically along the length of the tube. This improved tube design significantly lowers the average gas temperature and shortens the radial delay. A 27% increase in laser power was observed with the addition of septa. The authors have characterized the beam intensity profile, spatial and temporal pulse variation, and beam polarization through extensive laboratory measurements. A detailed computational model of the laser has been used to characterize and interpret the laboratory results.

28097 (UCRL-JC–115149) **New ytterbium-doped apatite crystals for flexible laser design.** Payne, S.A. (Lawrence Livermore National Lab., CA (United States)); DeLoach, L.D.; Smith, L.K.; Krupke, W.F.; Chai, B.H.T.; Loutts, G. Lawrence Livermore National Lab., CA (United States). Mar 1994. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-940226–8: 9. advanced solid-state lasers meeting, Salt Lake City, UT (United States), 7-10 Feb 1994). Order Number DE94015138. Source: OSTI; NTIS; GPO Dep.

A new class of Yb-lasers is summarized in this article. The apatite family of crystals has been found to impose favorable spectroscopic and laser properties on the Yb^{3+} activator ion. Crystals of Yb-doped $Ca_5(PO_4)_3F$, $Sr_5(PO_4)_3F$, $Ca_xSr_{5-x}(PO_4)_3F$, and $Sr_5(VO_4)_3F$ have been grown and investigated. Several useful laser crystals have been identified which offer a variety of fundamental laser parameters for designing diode-pumped systems. In general, this class of materials is characterized by high emission cross sections ($3.6–13.1 \times 10^{-20}$ cm^2), useful emission lifetimes (0.59–1.26 msec), a strong pump band ($\sigma_{abs} = 2.0–10.0 \times 10^{-20}$ cm^2) and pump and extraction wavelengths near 900 and 1,045 nm, respectively. Efficient lasing has been demonstrated for several of the members of this class of materials, and high optical quality crystals have been grown by the Czochralski method.

28098 (UCRL-JC–115511) **High-average-power, diode-pumped solid state lasers for energy and industrial applications.** Krupke, W.F. Lawrence Livermore National Lab., CA (United States). 2 Mar 1994. 12p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-9403144–1: 6. international symposium on advanced nuclear energy research, Mito (Japan), 23-25 Mar 1994). Order Number DE94015142. Source: OSTI; NTIS; INIS; GPO Dep.

Progress at LLNL in the development high-average-power diode-pumped solid state lasers is summarized, including the development of enabling technologies.

28099 (UCRL-JC–115712-Rev.1) **Performance characterization of photonic links in cryogenic environments for advanced signal processing applications: Revision 1.** McCammon, K. (Lawrence Livermore National Lab., CA (United States)); Morse, J.; Masquelier, D.; McConaghey, C.; Garrett, H.; Hugenberg, K.; Lowry, M.; Track, E.; Bunz, L. Lawrence Livermore National Lab., CA (United States). Jan 1994. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-940194–1-Rev.1: 4. annual Advanced Research Project Agency (ARPA) symposium on photonics systems for antenna applications, Monterey, CA (United States), 18-21 Jan 1994). Order Number DE94015561. Source: OSTI; NTIS; GPO Dep.

Low temperature experiments have been conducted to characterize the performance of high speed photodetectors and $LiNbO_3$ optical modulators in cryogenic environments down to 4.2 K. Metal-semiconductor-metal (MSM) photodiodes fabricated from GaAs and InGaAs have been characterized. Results demonstrate that both the responsivity and bandwidth depend on temperature. Specific modulator parameters quantified at cryogenic temperatures include bandwidth, V_π (half wave voltage), optical loss and package stability. The successful operation of MSM photodiodes and $LiNbO_3$ modulators at cryogenic temperatures enables a high sensitivity fiber optic approach to superconducting circuit interfaces.

28100 (UCRL-JC–116309) **Design of reliable high voltage avalanche transistor pulsers.** Fulkerson, E.S. (Lawrence Livermore National Lab., CA (United States)); Booth, R. Lawrence Livermore National Lab., CA (United States). Jun 1994. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-940678–5: 21. international power modulator symposium, Costa Mesa, CA (United States), 28-30 Jun 1994). Order Number DE94015323. Source: OSTI; NTIS; GPO Dep.

The authors have developed avalanche transistor based pulsers for use as pockel cell drivers and for impulse radar work. The output voltages range from 1 to 8kV, with rise times of 100 to 200 picoseconds and repetition rates in excess of 1kHz. Several of these units have been in service for over a year with no failures. The design of these units is discussed in detail, including circuit design, component selection, diagnostics, and the all important physical layout.

28101 (UCRL-JC–116742) **Laser physics of Nd^{3+}-doped phosphate glasses.** Payne, S.A. (Lawrence Livermore National Lab., CA (United States)); Bibeau, C.; Hayden, J.S. Lawrence Livermore National Lab., CA (United States). Mar 1994. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-940871–2: European quantum electronics conference '94, Amsterdam (Netherlands), 28 Aug - 2 sep 1994). Order Number DE94015141. Source: OSTI; NTIS; INIS; GPO Dep.

New data and analysis regarding the four fundamental processes that impact the laser performance of Nd-doped glasses will be discussed, including concentration quenching, Auger upconversion, the $^4I_{11/2}$ lower level lifetime, and hole-burning.

28102 (UCRL-JC–116823) **High power diode pumped solid state laser development at Lawrence Livermore National Laboratory.** Solarz, R. (and others); Albrecht, G.; Hackel, L. Lawrence

Livermore National Lab., CA (United States). Mar 1994. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-940554–1: 8. high temperature materials conference, Vienna (Austria), 5-8 May 1994). Order Number DE94015899. Source: OSTI; NTIS; GPO Dep.

The authors recent developments in high powered diode pumped solid state lasers at Lawrence Livermore National Laboratory. Over the past year the authors have made continued improvements to semiconductor pump array technology which includes the development of higher average power and lower cost pump modules. They report the performance of high power AlGaAs, InGaAs, and AlGaInP arrays. They also report on improvement to the integrated micro-optics designs in conjunction with lensing duct technology which gives rise to very high performance end pumping designs for solid state lasers which have major advantages which they detail. Substantial progress on beam quality improvements to near the diffraction limit at very high power have also been made and will be reported. They also will discuss recent experiments on high power non-linear materials for q-switches, harmonic converters, and parametric oscillators. Advances in diode pumped devices at LLNL which include tunable Cr:LiSrAlF$_6$, mid-IR Er:YAG, holmium based lasers and other developments will also be outlined. Concepts for delivering up to 30 kilowatts of average power from a DPSSL oscillator will be described.

28103 (UCRL-JC–117488) **Development of x-ray laser architectural components.** Wan, A.S. (and others); Da Silva, L.B.; Moreno, J.C. Lawrence Livermore National Lab., CA (United States). Jun 1994. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-940592–1: 4. international colloquium on X-ray lasers, Williamsburg, VA (United States), 16-20 May 1994). Order Number DE94016446. Source: OSTI; NTIS; INIS; GPO Dep.

This paper describes the recent experimental and computational development of short-pulse, enhanced-coherence, and high-brilliance x-ray lasers (XRLs). The authors will describe the development of an XRL cavity by injecting laser photons back into an amplifying XRL plasma. Using a combination of LASNEX/GLF/SPECTRE-BEAM3 codes, they obtained good agreement with experimental results. They will describe the adaptive spatial filtering technique used to design small-aperture shaped XRLs with near diffraction-limited output. Finally they will discuss issues concerning the development of high-brilliance XRL architecture, with emphasis on scaling the XRL aperture. Combining these advances in XRL architectural components allows them to develop a short-pulse, high-brilliance, coherent XRL suitable for applications in areas such as biological holography, plasma interferometry, and nonlinear optics.

43 PARTICLE ACCELERATORS

28104 (TRI-PP–91-34) **Some recollections on the story of the cyclotron and comments on higher degrees.** Richardson, J.R. TRIUMF, Vancouver, BC (Canada). May 1991. 4p. (CONF-910505–: 1991 Institute of Electrical and Electronics Engineers (IEEE) particle accelerator conference (PAC), San Francisco, CA (United States), 6-11 May 1991). Order Number DE94632506. Source: OSTI; NTIS (US Sales Only); INIS.

The author reminisces about his personal experiences with the development of the cyclotron, starting in Berkeley in 1934 and concluding with the proposed TRIUMF KAON factory. (L.L.).

28105 (TRI-PP–91-41) **The TRIUMF KAON factory.** Craddock, M.K. (British Columbia Univ., Vancouver, BC (Canada). Dept. of Physics). TRIUMF, Vancouver, BC (Canada). May 1991. 5p. (CONF-910505–: 1991 Institute of Electrical and Electronics Engineers (IEEE) particle accelerator conference (PAC), San Francisco, CA (United States), 6-11 May 1991). Order Number DE94632507. Source: OSTI; NTIS (US Sales Only); INIS.

The TRIUMF KAON Factory is designed to produce beams of kaons, antiprotons, other hadrons and neutrinos 100 times more intense, or cleaner, than are available now, for a broad range of particle and nuclear physics experiments. This will require a 100 μA beam of 30 GeV protons, to be produced by an interleaved sequence of two fast-cycling synchrotrons and three storage rings, with the existing TRIUMF H$^-$ cyclotron as injector. An $11-million preconstruction study has enabled the overall design to be reviewed and prototypes of various components to be built and evaluated -fast-cycling dipole and quadrupole magnets, a dual-frequency magnet power supply, ceramic beam pipes with internal RF shields, an RF cavity (using perpendicular bias), an extraction kicker, and RF beam chopper, and production targets. Environmental, industrial and economic impact studies have also been completed and the cost estimates and schedule updated. The total cost of $708 million (Canadian) will be shared equally between Canada, British Columbia (already approved) and international contributors. The federal decision is expected shortly. (Author) 29 refs., 5 figs.

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Refer also to citation(s) 27375, 28062, 28066, 28067, 28627, 28686

28106 (ANL/ASD/CP–81625) **Ground vibration model studies for APS storage ring.** Koul, R.K. Argonne National Lab., IL (United States). [1994]. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-940618–10: 4. European particle accelerator conference, London (United Kingdom), 27 Jun - 1 jul 1994). Order Number DE94015084. Source: OSTI; NTIS; INIS; GPO Dep.

An analytical ground vibration model is developed for study of the vibration effects on the beam motion in the Advanced Photon Source (APS) storage ring. The different physical parameters associated with the wave characteristics and the vibration modes needed for the study are taken from the vibration studies carried out at the APS site. The implementation has been carried out using Mathematica™. The study is carried out for the frequency range 1–35 Hz, with a number of sources changing from one through ten. The program written in Mathematica™, calculates orbit distortion, beta wave change, tune change, dispersion change, and chromaticity change. However, the main parameter studied for the APS storage ring has been the orbit distortion. The merit factor associated with different modes excited by the vibrations has been calculated.

28107 (ANL/TD/CP–82770) **Argonne CW Linac (ACWL) – Legacy from SDI and opportunities for the future.** McMichael, G.E.; Yule, T.J. Argonne National Lab., IL (United States). [1994]. 7p. Sponsored by Department of Defense, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-9407103–3: International conference on accelerated-driven transmutation technologies and applications, Las Vegas, NV (United States), 25-28 Jul 1994). Order Number DE94016350. Source: OSTI; NTIS; INIS; GPO Dep.

The former Strategic Defense Initiative Organization (SDIO) invested significant resources over a 6-year period to develop and build an accelerator to demonstrate the launching of a cw beam with characteristics suitable for a space-based Neutral Particle Beam (NPD) system. This accelerator, the CWDD (Continuous Wave Deuterium Demonstrator) accelerator, was designed to accelerate 80 mA cw of D$^-$ to 7.5 MeV. A considerable amount of hardware was constructed and installed in the Argonne-based facility, and major performance milestones were achieved before program funding from the Department of Defense ended in October 1993. Existing assets have been turned over to Argonne. Assets include a fully functional 200 kV cw D$^-$ injector, a cw RFQ that has been tuned, leak checked and aligned, beam lines and a high-power beam stop, all installed in a shielded vault with appropriate safety and interlock systems. In addition, there are two high power (1 MW) cw rf amplifiers and all the ancillary power, cooling and control systems required for a high-power accelerator system. The SDI mission required that the CWDD accelerator structures operate at cryogenic temperatures (26 K), a requirement that placed severe limitations on operating period (CWDD would have provided 20 seconds of cw beam every 90 minutes). However, the accelerator structures were designed for full-power rf operation with water cooling and ACWL (Argonne Continuous Wave Linac), the new name for CWDD in its water-cooled, positive-ion configuration, will be

able to operate continuously. Project status and achievements will be reviewed. Preliminary design of a proton conversion for the RFQ, and other proposals for turning ACWL into a testbed for cw-linac engineering, will be discussed.

28108 (BNL–49767) **High intensity proton operation at the Brookhaven AGS accelerator complex.** Ahrens, L.A. (and others); Blaskiewicz, M.; Bleser, E.; Brennan, J.M.; Gardner, C.; Glenn, J.W.; Onillon, E.; Reece, R.K.; Roser, T.; Soukas, A. Brookhaven National Lab., Upton, NY (United States). [1994]. 3p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH00016. (CONF-940618–19: 4. European particle accelerator conference, London (United Kingdom), 27 Jun - 1 jul 1994). Order Number DE94015824. Source: OSTI; NTIS; INIS; GPO Dep.

With the completion of the AGS rf upgrade, and the implementation of a transition "jump", all of accelerator systems were in place in 1994 to allow acceleration of the proton intensity available from the AGS Booster injector to AGS extraction energy and delivery to the high energy users. Beam commissioning results with these new systems are presented. Progress in identifying and overcoming other obstacles to higher intensity are given. These include a careful exploration of the stopband strengths present on the AGS injection magnetic porch, and implementation of the AGS single bunch transverse dampers throughout the acceleration cycle.

28109 (BNL–52415) **National synchrotron light source: [Annual report], October 1, 1992–September 30, 1993.** Rothman, E.Z.; Hulbert, S.L.; Lazarz, N.M. (eds.). Brookhaven National Lab., Upton, NY (United States). Apr 1994. 459p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH00016. Order Number DE94015839. Source: OSTI; NTIS; INIS; GPO Dep.

This report contains brief discussions on the research being conducted at the National Synchrotron Light source. Some of the topics covered are: X-ray spectroscopy; nuclear physics; atomic and molecular science; meetings and workshops; operations; and facility improvements.

28110 (DOE/ER/54160–1-Vol.3, pp. 1855-1860) **CLIA - a Compact Linear Induction Accelerator System.** Ashby, S. (Physics International Co., San Leandro, CA (United States)); Drury, D.; Sincerny, P.; Thompson, L.; Schlitt, L. Maryland Univ., College Park, MD (United States). [1992]. (CONF-920515–Vol.3: 9. international conference on high power particle beams, Washington, DC (United States), 25-29 May 1992). In *Beams 92: Proceedings: Volume 3, Microwaves, Free electron lasers, Advanced accelerators, Applications, and Plasma discharges.* 681p. Order Number DE94014785. Source: OSTI; NTIS; INIS.

CLIA (Compact Linear Induction Accelerator) is a 750 kV, 10 kA, 60 ns, 200 Hz pulse generator that has been designed, constructed, and operated at Physics International. The CLIA system consists of (from the load back to the mains) a ten-cell linear induction voltage adder, ten magnetically switched water insulated pulse forming lines (PFL's), a two-stage Magnetic Compression Unit (MCU), and thyratron-switched Intermediate Energy Store (IES), and Command Resonant Charge (CRC) units. This system was conceived to drive repetitive e-beam loads for various types of repetitive testing. A linear induction accelerator system was used because it allows all pulse compression to be done at moderate voltage (40 to 150 kV) and then uses the accelerator structure to add parallel voltage pulses into a single high voltage output (750 kV). Nowhere except at the load does a voltage of higher than 150 kV appear. This allows the switching to be done at moderate voltage and the use of hydrogen thyratrons and magnetic switches is possible. This generator has been in operation at Physics International for over a year and has achieved all its design goals. The design and operational characteristics of the accelerator will be described in this paper.

28111 (DOE/ER/54160–1-Vol.3, pp. 1870-1875) **Recent advances in induction acceleration and postacceleration of high-current beams at Tomsk Nuclear Physics Institute.** Vasiljev, V.V. (Nuclear Physics Institute of Tomsk (Russian Federation)); Ivanov, I.B.; Kanaev, G.G.; Tomskikh, O.N.; Usov, Yu.P.; Furman, E.G. Maryland Univ., College Park, MD (United States). [1992]. (CONF-920515–Vol.3: 9. international conference on high power particle beams, Washington, DC (United States), 25-29 May 1992). In *Beams 92: Proceedings: Volume 3, Microwaves, Free electron lasers, Advanced accelerators, Applications, and Plasma discharges.* 681p. Order Number DE94014785. Source: OSTI; NTIS; INIS.

In Tomsk Nuclear Physics Institute (NPI) work on designing high power electron beam accelerators has been going on since 1970. Since 1975 NPI has been working also on the development of the cell base of linear induction accelerators (LIA) and creation of installations for research and industry. The main advantage and the principle difference of LIAs from direct accelerators consists in the possibility to decrease the size of the device and the absence of limitations on the maximum energy of accelerated particles.

28112 (DOE/FTR–94006183) **Travel to Germany for work with the TESLA collaboration at Deutsches Elektronen-Synchrotron: Foreign trip report, 1 July 1992–31 December 1993.** Peterson, T.J. Fermi National Accelerator Lab., Batavia, IL (United States). 1 Jan 1994. 15p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH03000. Order Number DE94006183. Source: OSTI; NTIS (US Sales Only); GPO Dep.

In the framework of an international collaboration of more than 12 accelerator laboratories, the concept of a linear accelerator of superconducting high frequency resonators was developed: TESLA (TeV Superconducting Linear Accelerator). In order to demonstrate the Feasibility of superconducting technology for an e+/e– collider with collision energies in the center of mass in the range of 300 GeV to 1 TeV, this collaboration has established a research and development program. The immediate goal of the R&D program is to build and operate a 50 meter-long linac at DESY with 1.3 GHz superconducting RF cavities at a temperature of 1.8 K to 2.0 K and an accelerating gradient of 15 MV/meter. This test linac and the associated Facilities for assembling and testing the components of the linac are called the TESLA Test Facility (TTF). A second major task of the collaboration is to do preliminary design studies of a 500 GeV e+/e– superconducting linear collider (TESLA). Working primarily as a cryogenic engineer in the cryogenics group at DESY, my work involved cryogenics for both TTF and TESLA. For TTF we have made a general design of the cryogenic cooling scheme, which includes two vertical test cryostats, a horizontal test cryostat, and the cooling for the 50 meter linac. The cryogenic supply to the first vertical cryostat is complete. During the last week of December it was cooled to 1.4 K, and a cooling capacity of 100 Watts at 1.8 K (the design goal) was demonstrated. Preliminary schemes for a TESLA cooling system have been made but are still being revised.

28113 (FNAL/C–94/181) **Commissioning and first operational experience of the 400 MeV Linac at Fermilab.** Junck, K.; Allen, L.; Kroc, T.; MacLachlan, J.; McCrory, E.; Moretti, A.; Noble, R.; Popovic, M.; Schmidt, C. Fermi National Accelerator Lab., Batavia, IL (United States). Jul 1994. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH03000. (CONF-940618–18: 4. European particle accelerator conference, London (United Kingdom), 27 Jun - 1 jul 1994). Order Number DE94015524. Source: OSTI; NTIS; INIS; GPO Dep.

Commissioning of the Fermilab High Energy Linac during September and October of 1993 has increased the energy of the H- linac from 200 to 400 MeV. The Linac Upgrade is one portion of the Fermilab Upgrad and is intended to reduce the incoherent space-charge tuneshift at injection into the 8 GeV Booster. To accomplish this increase in energy within the existing enclosure, four 201.25 MHz drift-tube linac tankshave been replaced by seven 805 MHz side-coupled cavity modules to accelerate the beam from 116 MeV to 400 MeV. Each module is driven with a klystron amplifier delivering 10 MW of peak power for 60 μsec with a maximum pulse repetition rate of 15 Hz. Nominal beam current is 35 mA with a pulselength of 40 μsec. Results from commissioning and operational experience during Fermilab Collider Run 1B are presented.

28114 (FNAL/C–94/192) **Increasing the energy of the Fermilab Tevatron accelerator.** Fuerst, J.D.; Theilacker, J.C. Fermi National Accelerator Lab., Batavia, IL (United States). Jul 1994. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH03000. (CONF-940618–21: 4. European particle accelerator conference, London (United Kingdom), 27 Jun - 1

jul 1994). Order Number DE94015539. Source: OSTI; NTIS; INIS; GPO Dep.

The superconducting Tevatron accelerator at Fermilab has reached its eleventh year of operation since being commissioned in 1983. Last summer, four significant upgrades to the cryogenic system became operational which allow Tevatron operation at higher energy. This came after many years of R&D, power testing in sectors (one sixth) of the Tevatron, and final system installation. The improvements include the addition of cold helium vapor compressors, supporting hardware for subatmospheric operation, a new satellite refrigerator control system, and a higher capacity central helium liquefier. A description of each cryogenic upgrade, commissioning experience, and attempts to increase the energy of the Tevatron are presented.

28115 (LA-UR–94-2249) **APT radionuclide production experiment.** Ullmann, J.L. (and others); Gavron, A.; King, J.D. Los Alamos National Lab., NM (United States). 2 Jul 1994. 55p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. Order Number DE94016079. Source: OSTI; NTIS; GPO Dep.

Tritium (^{3}H, a heavy isotope of hydrogen) is produced by low energy neutron-induced reactions on various elements. One such reaction is n+^{3}He →> ^{3}H+^{1}H in which ^{3}He is transmuted to tritium. Another reaction, which has been used in reactor production of tritium, is the n+^{6}Li →> ^{3}H+^{4}He reaction. Accelerator Production of Tritium relies on a high-energy proton beam to produce these neutrons using the spallation reaction, in which high-energy proton beam to produce these neutrons using the spallation reaction, in which high-energy protons reacting with a heavy nucleus produce a shower of low-energy neutrons and a lower-mass residual nucleus. It is important to quantify the residual radionuclides produced in the spallation target for two reasons. From an engineering point of view, one must understand short-lived isotopes that may contribute to decay heat. From a safety viewpoint, one must understand what nuclei and decay gammas are produced in order to design adequate shielding, to estimate ultimate waste disposal problems, and to predict possible effects due to accidental dispersion during operation. The authors have performed an experiment to measure the production of radioisotopes in stopping-length W and Pb targets irradiated by a 800 MeV proton beam, and are comparing the results to values obtained from calculations using LAHET and MCNP. The experiment was designed to pay particular attention to the short half-life radionuclides, which have not been previously measured. In the following, they present details of the experiment, explain how they analyzed the data and obtain the results, how they perform the calculations, and finally, how the experimental data agree with the calculations.

28116 (LA-UR–94-2439) **Critical design issues of high intensity proton linacs.** Lawrence, G.P. Los Alamos National Lab., NM (United States). [1994]. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-940618–30: 4. European particle accelerator conference, London (United Kingdom), 27 Jun - 1 jul 1994). Order Number DE94016183. Source: OSTI; NTIS; INIS; GPO Dep.

Medium-energy proton linear accelerators are being studied as drivers for spallation applications requiring large amounts of beam powder. Important design factors for such high-intensity linacs are reviewed, and issues and concerns specific to this unprecedented power regime are discussed.

28117 (LA-UR–94-2483) **A new RFQ linac fabrication technique.** Schrage, D.; Roybal, P.; Young, L.; Clark, W.; DePaula, R.; Martinez, F. Los Alamos National Lab., NM (United States). [1994]. 4p. Sponsored by Defense Nuclear Agency, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-9408125–3: 17. international LINAC conference, Tsukuba (Japan), 21-26 Aug 1994). Order Number DE94016093. Source: OSTI; NTIS; INIS; GPO Dep.

The use of hydrogen furnace brazing has been applied as a joining technology to the fabrication of a Radio-Frequency-Quadrupole (RFQ) linac for the Los Alamos Accelerator Performance Demonstration Facility (APDF). The design concept provides a monolithic cavity with no longitudinal rf, vacuum, or mechanical joints. A 530 MHz, 0.46 meter long engineering model RFQ has been fabricated and tested at the Los Alamos National Laboratory as a technical demonstration of this concept. It is planned that two funneled RFQ's for the APDF (7 MeV, 350 MHz, 100 mAmp CW, each eight meters in length) will be manufactured by this method.

28118 **High brightness electron accelerator.** Sheffield, R.L.; Carlsten, B.E.; Young, L.M. To Dept. of Energy. 1992. Filed date 17 Jul 1992. U.S. Patent Application 7-914,327. 19p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. Order Number DE94016134. Source: OSTI; NTIS; INIS; GPO Dep.

A compact high brightness linear accelerator is provided for use, e.g., in a free electron laser. The accelerator has a first plurality of accelerating cavities having end walls with four coupling slots for accelerating electrons to high velocities in the absence of quadrupole fields. A second plurality of cavities receives the high velocity electrons for further acceleration, where each of the second cavities has end walls with two coupling slots for acceleration in the absence of dipole fields. The accelerator also includes a first cavity with an extended length to provide for phase matching the electron beam along the accelerating cavities. A solenoid is provided about the photocathode that emits the electrons, where the solenoid is configured to provide a substantially uniform magnetic field over the photocathode surface to minimize emittance of the electrons as the electrons enter the first cavity.

28119 (TRI-PP–91-7) **The TRIUMF KAON factory project.** Poutissou, J.M. TRIUMF, Vancouver, BC (Canada). Apr 1991. 24p. (CONF-9104312–: Workshop on physics and detectors for DAPHNE, Frascati (Italy), 9-12 Apr 1991). Order Number DE94632515. Source: OSTI; NTIS (US Sales Only); INIS.

A 100 μA 30 GeV facility, named KAON, could soon be developed at TRIUMF using the present cyclotron as an injector. A wide variety of beams would be provided which would accommodate a very diversified physics program. A flavour of the experimental program will be given together with an outlook of the facilities currently planned for the initial program. (Author) 8 refs., 11 figs., 5 tabs.

28120 (TRI-PP–91-25) **Contemporary approaches to control system specification and design applied to KAON.** Ludgate, G.A. (TRIUMF, Vancouver, BC (Canada)); Osberg, E.A.; Dohan, D.A. TRIUMF, Vancouver, BC (Canada). May 1991. 3p. (CONF-910505–: 1991 Institute of Electrical and Electronics Engineers (IEEE) particle accelerator conference (PAC), San Francisco, CA (United States), 6-11 May 1991). Order Number DE94632513. Source: OSTI; NTIS (US Sales Only); INIS.

Large data acquisition and control systems have evolved from early centralized computer systems to become multi-processor, distributed systems. While the complexity of these systems has increased our ability to reliably manage their construction has not kept pace. Structured analysis and real-time structured analysis have been used successfully to specify systems but, from a project management viewpoint, both lead to different classes of problems during implementation and maintenance. The KAON Factory central control system study employed a uniform approach to requirements analysis and architectural design. The methodology was based on well established object-oriented principles and was free of the problems inherent in the older methodologies. The methodology is presently being used to implement two systems at TRIUMF. (Author) 12 refs.

28121 (TRI-PP–91-29) **Program DIMAD: Vectorization, links with DA, LIELIB, and COSY-∞.** Servranckx, R.V. TRIUMF, Vancouver, BC (Canada). May 1991. 1p. (CONF-910505–: 1991 Institute of Electrical and Electronics Engineers (IEEE) particle accelerator conference (PAC), San Francisco, CA (United States), 6-11 May 1991). Order Number DE94632514. Source: OSTI; NTIS (US Sales Only); INIS.

Further adequate analysis of the stability properties of the KAON Factory rings will require the tracking of particles for at least 20 thousand turns, a good analysis of the tracking results and a flexible tool to analyse and correct coupling resonances. This paper describes the approach followed to achieve those goals with the programs DIMAD, DA, LIELIB and COSY-∞. (Author) 3 refs.

28122 (TRI-PP–92-13) **KAON project and prospects.** Numao, T. TRIUMF, Vancouver, BC (Canada). Jan 1992. 6p. (CONF-9112111–: KEK workshop on rare kaon decay physics, Tsukuba (Japan), 10-11 Dec 1991). Order Number DE94632516. Source: OSTI; NTIS (US Sales Only); INIS.

The KAON factory project and the current status are briefly described. Typical rare decay and CP violation experiments and their physics are discussed. (Author) 20 refs., 4 figs.

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Refer also to citation(s) 28068, 28152, 28154, 28162, 28212, 28244, 28268, 28270, 28605

28123 (ANL/OTD-APS/CP–81858) **Injection and capture simulations for a high intensity proton synchrotron.** Cho, Y. (Argonne National Lab., IL (United States)); Lessner, E.; Symon, K. Argonne National Lab., IL (United States). [1994]. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-940618–12: 4. European particle accelerator conference, London (United Kingdom), 27 Jun - 1 jul 1994). Order Number DE94015022. Source: OSTI; NTIS; INIS; GPO Dep.

The injection and capture processes in a high intensity, rapid cycling, proton synchrotron are simulated by numerical integration. The equations of motion suitable for rapid numerical simulation are derived so as to maintain symplecticity and second-order accuracy. By careful bookkeeping, the authors can, for each particle that is lost, determine its initial phase space coordinates. They use this information as a guide for different injection schemes and rf voltage programming, so that a minimum of particle losses and dilution are attained. A fairly accurate estimate of the space charge fields is required, as they influence considerably the particle distribution and reduce the capture efficiency. Since the beam is represented by a relatively coarse ensemble of macro particles, the authors study several methods of reducing the statistical fluctuations while retaining the fine structure (high intensity modulations) of the beam distribution. A pre-smoothing of the data is accomplished by the cloud-in-cell method. The program is checked by making sure that it gives correct answers in the absence of space charge, and that it reproduces the negative mass instability properly. Results of simulations for stationary distributions are compared to their analytical predictions. The capture efficiency for the rapid-cycling synchrotron is analyzed with respect to variations in the injected beam energy spread, bunch length, and rf programming.

28124 (BNL–52381) **Crystalline beam ground state.** Wei, Jie (Brookhaven National Lab., Upton, NY (United States)); Li, Xiao-Ping; Sessler, A.M. Brookhaven National Lab., Upton, NY (United States); Lawrence Berkeley Lab., CA (United States). 11 Jun 1993. 33p. Sponsored by USDOE, Washington, DC (United States);National Science Foundation, Washington, DC (United States). DOE Contract AC02-76CH00016 ; AC03-76SF00098. DMR-91-15342. Order Number DE94016578. Source: OSTI; NTIS; INIS; GPO Dep.

In order to employ molecular dynamics (MD) methods, commonly used in condensed matter physics, we have derived the equations of motion for a beam of charged particles in the rotating rest frame of the reference particle. We include in the formalism that the particles are confined by the guiding and focusing magnetic fields, and that they are confined in a conducting vacuum pipe while interacting with each other via a Coulomb force. Numerical simulations using MD methods has been performed to obtain the equilibrium crystalline beam structure. The effect of the shearing force, centrifugal force, and azimuthal variation of the focusing strength are investigated. It is found that a constant gradient storage ring can not give a crystalline beam, but that an alternating-gradient (AG) structure can. In such a machine the ground state is, except for one-dimensional (1-D) crystals, time dependent. The ground state is a zero entropy state, despite the time-dependent, periodic variation of the focusing force. The nature of the ground state, similar to that found by Schiffer et al. depends upon the density and the relative focusing strengths in the transverse directions. At low density, the crystal is 1-D. As the density increases, it transforms into various kinds of 2-D and 3-D crystals. If the energy of the beam is higher than the transition energy of the machine, the crystalline structure can not be formed for lack of radial focusing.

28125 (DOE/ER/40747–10) **The partial snake experiment at the AGS: Progress report, 15 August 1992–14 August 1994.** Lee, S.Y. Indiana Univ., Bloomington, IN (United States). Dept. of Physics. 15 Jul 1993. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-92ER40747. Order Number DE94015631. Source: OSTI; NTIS; INIS; GPO Dep.

In the two year funding period from August 15, 1992–August 14, 1994, the authors progresses can be summarized as follows: (1) the solenoidal partial snake was installed in the AGS synchrotron in May, 1993 and was subsequently successfully tested; (2) the internal polarimeter for the AGS was assembled, tested and installed in the AGS; (3) the 200 MeV polarimeter at the LINAC was tested; (4) the AGS polarized ion source was renovated; (5) the first phase of the polarized beam experiments was successfully accomplished in April 1–8, 1994, of polarized proton acceleration up to $G\gamma \approx 20$; (6) they are currently renovating tune jump quadrupoles in order to accelerate polarized proton up to 25 GeV/c. The full test of these experiments will be in 1995. During this funding period, the principal investigator has spent about 20% of his research time on this project, which includes the design and manufacturing of the solenoid partial snake, beam dynamics issues of the AGS with the 5% solenoid partial snake and spin dynamics of synchrotrons with snakes in general. The graduate student, Mr. H. Huang has spent 100% of his research time working on spin dynamics. The graduate student is currently staying at BNL for the E880 experiment preparation.

28126 (DOE/ER/54160–1-Vol.3, pp. 1783-1788) **Model of cavity coupling for beam breakup control.** Colombant, D.G. (Naval Research Lab., Washington, DC (United States)); Lau, Y.Y. Maryland Univ., College Park, MD (United States). [1992]. (CONF-920515–Vol.3: 9. international conference on high power particle beams, Washington, DC (United States), 25-29 May 1992). In *Beams 92: Proceedings: Volume 3, Microwaves, Free electron lasers, Advanced accelerators, Applications, and Plasma discharges.* 681p. Order Number DE94014785. Source: OSTI; NTIS; INIS.

The coupling of the accelerating cavities to dummy cavities was recently found to reduce beam breakup growth. This paper analyzes a more sophisticated model, that includes the time delay between coupled cavities and covers the possibilities of wave cutoff and resonance in the coupling path. A dispersion relation is obtained. The authors show that the peak spatial exponentiation rate of the dominant BBU mode is reduced by as much as a factor of two, and this reduction is insensitive to the coupling path length. Other modes are destabilized, however, but they have lower growth rates, in general.

28127 (DOE/ER/54160–1-Vol.3, pp. 1789-1794) **Experiments on the excitation and coupled-cavity suppression of beam-breakup-instability in long-pulse electron beam transport.** Gilgenbach, R.M. (Univ. of Michigan, Ann Arbor, MI (United States)); Menge, P.R.; Walter, M.T.; Ching, C.H.; Foster, J.; Ventzek, P.L.G. Maryland Univ., College Park, MD (United States). [1992]. (CONF-920515–Vol.3: 9. international conference on high power particle beams, Washington, DC (United States), 25-29 May 1992). In *Beams 92: Proceedings: Volume 3, Microwaves, Free electron lasers, Advanced accelerators, Applications, and Plasma discharges.* 681p. Order Number DE94014785. Source: OSTI; NTIS; INIS.

Experiments have been performed to excite and suppress the beam breakup (BBU) instability in long pulse electron beam transport through RF cavity systems. Electron beams are generated by the Michigan Electron Long Beam Accelerator (MELBA) at parameters: V = 0.7-0.8 MV, I_{diode} = 1-10 kA, $I_{injected}$ = 100-400 A, and pulselength = 0.5-1 μs. The transport system consists of a solenoidal magnetic field with 10 RF cavities. The TM_{110} mode BBU resonance frequency of the cavities is 2.5 GHz and the cavity Q is adjusted to about 200-300. Each cavity has a small coupling loop oriented to detect the RF field in the TM_{110} mode. The cavities are separated by 6.5-cm-long sections of tubing which are cutoff to the RF frequency. The BBU instability is primed by a kW level microwave signal injected into the first cavity from a magnetron.

Growth of the RF is measured between the second cavity and the last cavity. Strong growth (2-5 dB per cavity) is only observed when the RF priming signal is tuned to the exact TM_{110} mode resonance frequency ($\delta f/f_0 \ll 1\%$). Experiments to test techniques for suppression of the BBU instability are also being performed. The primary BBU suppression technique being investigated is cavity cross-coupling, in which 7 out of 10 internal beam-cavities are connected by cables to 7 identical cavities located externally to the e-beam. These are the first experiments which have shown a consistent reduction (about -6 dB average) in BBU microwave growth when external cavities are coupled to the internal cavity system.

28128 (DOE/ER/54160–1-Vol.3, pp. 1795-1800) **Electron flow in positive-polarity multigap inductive accelerators.** Church, B.W. (Cornell Univ., Ithaca, NY (United States)); Sudan, R.N. Maryland Univ., College Park, MD (United States). [1992]. Contract 63-4881; Grant N00014-89-J-1770. (CONF-920515–Vol.3: 9. international conference on high power particle beams, Washington, DC (United States), 25-29 May 1992). In *Beams 92: Proceedings: Volume 3, Microwaves, Free electron lasers, Advanced accelerators, Applications, and Plasma discharges.* 681p. Order Number DE94014785. Source: OSTI; NTIS; INIS.

The authors study the electron flow in multi-gap inductive accelerators, such as Hermes III operating in positive polarity by numerical simulation and modeling. The objective of this work is to determine the operating principles such that an optimally efficient design of the Hermes-type machine can be achieved for intense ion beam generation. They employ a 2-D fully electromagnetic particle in cell code, MASK, to represent the electrons emitted in the accelerating gaps and their dynamics. Because the electrons emitted in different gaps have different energies and canonical momenta, the simple theory of magnetic insulation has to be extended to such multi-component electron flows. In order to understand the effects of load impedance on the electron flows in the multi-gap accelerator and on the coupling of power to the load, MASK has been used to simulate an accelerator with a small number of gaps for various load impedances. For load impedances below the self-limited impedance Z_{SL} of the last segment of the accelerator, the electron flow in both segments is well insulated. The overall current efficiency is over 90% and is insensitive to the load impedance Z_L for $Z_L < Z_{SL}$. Beyond Z_{SL}, the current efficiency decreases rapidly with increasing load impedance. Because of this rapid decrease in efficiency, the power delivered to the load also falls off rapidly as load impedance is increased. To better understand these results, a simple theoretical model for multi-component electron flows has been developed to predict the distribution of electron flows. The model is compared with existing multi-component models and simulations.

28129 (DOE/ER/54160–1-Vol.3, pp. 1801-1806) **Simulations of multistage intense ion beam acceleration.** Slutz, S.A. (Sandia National Labs., Albuquerque, NM (United States)); Poukey, J.W. Maryland Univ., College Park, MD (United States). [1992]. DOE Contract AC04-76DP00789. (CONF-920515–Vol.3: 9. international conference on high power particle beams, Washington, DC (United States), 25-29 May 1992). In *Beams 92: Proceedings: Volume 3, Microwaves, Free electron lasers, Advanced accelerators, Applications, and Plasma discharges.* 681p. Order Number DE94014785. Source: OSTI; NTIS; INIS.

An analytic theory for magnetically insulated, multistage acceleration of high intensity ion beams, where the diamagnetic effect due to electron flow is important, has been presented by Slutz and Desjarlais. The theory predicts the existence of two limiting voltages called $V_1(W)$ and $V_2(W)$, which are both functions of the injection energy qW of ions entering the accelerating gap. As the voltage approaches $V_1(W)$, unlimited beam-current density can penetrate the gap without the formation of a virtual anode because the dynamic gap goes to zero. Unlimited beam current density can penetrate an accelerating gap above $V_2(W)$, although a virtual anode is formed. It was found that the behavior of these limiting voltages is strongly dependent on the electron density profile. The authors have investigated the behavior of these limiting voltages numerically using the 2-D particle-in-cell (PIC) code MAGIC. Results of these simulations are consistent with the superinsulated analytic results. This is not surprising, since the ignored coordinate eliminates instabilities known to be important from studies of single stage magnetically insulated ion diodes. To investigate the effect of these instabilities the authors have simulated the problem with the 3-D PIC code QUICKSILVER, which indicates behavior that is consistent with the saturated model.

28130 (DOE/ER/54160–1-Vol.3, pp. 1807-1812) **Prospects of cyclotron resonance laser acceleration.** Chen, C. (Massachusetts Institute of Technology, Cambridge, MA (United States)). Maryland Univ., College Park, MD (United States). [1992]. (CONF-920515–Vol.3: 9. international conference on high power particle beams, Washington, DC (United States), 25-29 May 1992). In *Beams 92: Proceedings: Volume 3, Microwaves, Free electron lasers, Advanced accelerators, Applications, and Plasma discharges.* 681p. Order Number DE94014785. Source: OSTI; NTIS; INIS.

The cyclotron resonance laser (CRL) accelerator is a novel concept of accelerating continuous charged-particle beams to moderately or highly relativistic energies. This paper discusses the prospects and limitations of this concept. In particular, a three-dimensional, self-consistent theory is used to analyze the nonlinear interaction of an electron beam with an intense traveling electromagnetic wave in such an accelerator. The parameter regimes of experimental interest are identified on the basis of scaling calculations. The results of simulation modeling of a multi-megavolt electron CRL accelerator are presented. The possibility of building continuous-wave (CW) CRL accelerators is discussed.

28131 (DOE/ER/54160–1-Vol.3, pp. 1813-1818) **Numerical simulations of density channel guiding and relativistic optical guiding of laser pulses in a plasma.** Krall, J. (Naval Research Lab., Washington, DC (United States)); Joyce, G.; Sprangle, P.; Esarey, E. Maryland Univ., College Park, MD (United States). [1992]. (CONF-920515–Vol.3: 9. international conference on high power particle beams, Washington, DC (United States), 25-29 May 1992). In *Beams 92: Proceedings: Volume 3, Microwaves, Free electron lasers, Advanced accelerators, Applications, and Plasma discharges.* 681p. Order Number DE94014785. Source: OSTI; NTIS; INIS.

In the laser wakefield accelerator, a short ($\tau_L < 1$ ps), high power ($P > 10^{12}$ W) laser pulse propagates in plasma to generate a large amplitude ($E > 1$ GV/m) wakefield. The authors present an axisymmetric nonlinear fluid model that allows simulation of laser pulse propagation through a plasma on the plasma time scale. They find that a laser pulse will propagate through a plasma for many vacuum diffraction lengths if either of two conditions are met: (1) an appropriately shaped plasma density channel can be obtained or (2) an ultra-high power tailored laser pulse can be created.

28132 (DOE/ER/54160–1-Vol.3, pp. 1819-1824) **Two-beam virtual cathode accelerator.** Peter, W. (Ben-Gurion Univ., Beersheva (Israel)). Maryland Univ., College Park, MD (United States). [1992]. (CONF-920515–Vol.3: 9. international conference on high power particle beams, Washington, DC (United States), 25-29 May 1992). In *Beams 92: Proceedings: Volume 3, Microwaves, Free electron lasers, Advanced accelerators, Applications, and Plasma discharges.* 681p. Order Number DE94014785. Source: OSTI; NTIS; INIS.

A proposed method to control the motion of a virtual cathode is investigated. Applications to collective ion acceleration and microwave generation are indicated. If two counterstreaming relativistic electron beams of current I are injected into a drift tube of space-charge-limiting current $I_L = 2I$, it is shown that one beam can induce a moving virtual cathode in the other beam. By dynamically varying the current injected into the drift tube region, the virtual cathode can undergo controlled motion. For short drift tubes, the virtual cathodes on each end are strongly-coupled and undergo coherent large-amplitude spatial oscillations within the drift tube.

28133 (DOE/ER/54160–1-Vol.3, pp. 1825-1830) **Experimental studies of beam acceleration with a short pulse X-band electron cyclotron maser.** Kamada, Keiichi (Kanazawa Univ. (Japan)); Kanazawa, Tatsuki; Sakamoto, Mitsunori; Matsumura, Noboru; Tamagawa, Fumiyasu; Ando, Ritoku; Masuzaki, Masaru; Kawasaki, Sunao. Maryland Univ., College Park, MD (United States). [1992]. (CONF-920515–Vol.3: 9. international conference on high power particle beams, Washington, DC (United States), 25-29 May 1992).

In *Beams 92: Proceedings: Volume 3, Microwaves, Free electron lasers, Advanced accelerators, Applications, and Plasma discharges.* 681p. Order Number DE94014785. Source: OSTI; NTIS; INIS.

An experiment of the Two-Beam Acceleration is reported. An intense short microwave pulse of X-band generated with an IREB on a gyro-BWO was utilized. A matter of main concern is whether the radiation could really serve as the power source for acceleration of another electron beam even with its short pulse duration (a few ns). The microwave fed to the series of cavities where a 50 keV electron beam was injected. A part of the beam particles got the energy of 5 keV. The result is explained in the framework of the ordinary theory of the rf accelerating structures and shows that the TBA scheme will be operated successfully with appropriate choice of the parameters.

28134 (DOE/ER/54160–1-Vol.3, pp. 1831-1836) **Collective acceleration of light ion beams in KALI-200.** Vijayan, T. (Bhabha Atomic Research Centre, Bombay (India)); Roychowdhury, P.; Iyyengar, S.K. Maryland Univ., College Park, MD (United States). [1992]. (CONF-920515–Vol.3: 9. international conference on high power particle beams, Washington, DC (United States), 25-29 May 1992). In *Beams 92: Proceedings: Volume 3, Microwaves, Free electron lasers, Advanced accelerators, Applications, and Plasma discharges.* 681p. Order Number DE94014785. Source: OSTI; NTIS; INIS.

Collective acceleration of light ion beams has been studied by injecting a REB of 250 keV, 5kA, 60 ns into a short dielectric tube in vacuum situated inside a conducting tube. The ion energies obtained by using this moderately intense beam, are around 1-3 MeV per nucleon with total currents reaching about tens of Amperes.

28135 (DOE/ER/54160–1-Vol.3, pp. 1843-1848) **SUPERFISH post-processor for IBM-PC compatible computers.** Humphries, S. Jr. (Univ. of New Mexico, Albuquerque, NM (United States)). Maryland Univ., College Park, MD (United States). [1992]. (CONF-920515–Vol.3: 9. international conference on high power particle beams, Washington, DC (United States), 25-29 May 1992). In *Beams 92: Proceedings: Volume 3, Microwaves, Free electron lasers, Advanced accelerators, Applications, and Plasma discharges.* 681p. Order Number DE94014785. Source: OSTI; NTIS; INIS.

The SUPERFISH program calculates the fields of resonant modes in accelerating cavities and other structures. A new version for 386 and 486 personal computers achieves the functionality of the standard Cray version and has significantly expanded post-analysis capabilities.

28136 (DOE/ER/54160–1-Vol.3, pp. 1849-1854) **Simulation studies of beam quality in high-gradient accelerators.** Joyce, G. (Naval Research Lab., Washington, DC (United States)); Krall, J. Maryland Univ., College Park, MD (United States). [1992]. (CONF-920515–Vol.3: 9. international conference on high power particle beams, Washington, DC (United States), 25-29 May 1992). In *Beams 92: Proceedings: Volume 3, Microwaves, Free electron lasers, Advanced accelerators, Applications, and Plasma discharges.* 681p. Order Number DE94014785. Source: OSTI; NTIS; INIS.

The authors use particle simulation techniques to model an idealized induction accelerator geometry. They study the effect of high accelerating gradients on the transverse dynamics of the electron beam. Under these conditions, the significant measure of beam quality is emittance. The model includes the gap fields, but neglects the effect of the gap geometry on the self-fields of the electron beam. The results show that high gradient induction gaps can cause non-linear radial perturbations of the beam. If high enough energies are reached, these perturbations do not adversely affect the beam emittance.

28137 (DOE/ER/54160–1-Vol.3, pp. 1867-1875) **High-current linear accelerator.** Mozgovoy, A.G. (P.N. Lebedev Physical Institute, Moscow (Russian Federation)). Maryland Univ., College Park, MD (United States). [1992]. (CONF-920515–Vol.3: 9. international conference on high power particle beams, Washington, DC (United States), 25-29 May 1992). In *Beams 92: Proceedings: Volume 3, Microwaves, Free electron lasers, Advanced accelerators, Applications, and Plasma discharges.* 681p. Order Number DE94014785. Source: OSTI; NTIS; INIS.

A pulsed linear accelerator for an energy of tens of MeV and beam current of tens of kA and pulse duration of tens of nanoseconds is described. The accelerating section, located in a common tank and joined by drift chambers, are fed by cables from a single source - a powerful pulse-forming line. Synchronization is achieved by proper choice of cable lengths.

28138 (DOE/ER/54160–1-Vol.3, pp. 1881-1886) **Beam matching into the DARHT LINAC.** Hughes, T.P. (Mission Research Corp., Albuquerque, NM (United States)); Moir, D.C.; Carlson, R.L. Maryland Univ., College Park, MD (United States). [1992]. (CONF-920515–Vol.3: 9. international conference on high power particle beams, Washington, DC (United States), 25-29 May 1992). In *Beams 92: Proceedings: Volume 3, Microwaves, Free electron lasers, Advanced accelerators, Applications, and Plasma discharges.* 681p. Order Number DE94014785. Source: OSTI; NTIS; INIS.

The DARHT (Dual-Axis Radiographic Hydro-Test) Facility is a large flash x-ray radiography facility to be built at Los Alamos National Lab. (LANL). Prototyping of the beam injector and first block of eight accelerating cells is being carried out at the Intermediate Test Stand (ITS) at LANL. The authors have carried out numerical calculations using particle-in-cell and envelope codes to model initial beam transport experiments. The results agree reasonably well with experimental measurements of transported current and beam spot-size.

28139 (DOE/ER/54160–1-Vol.3, pp. 1887-1892) **HITMI: Experiments with an electron-beam driven vacuum linear induction accelerator.** Ekdahl, C. (Los Alamos National Lab., CA (United States)); Humphries, S. Jr.; Rix, B.; Warn, C. Maryland Univ., College Park, MD (United States). [1992]. (CONF-920515–Vol.3: 9. international conference on high power particle beams, Washington, DC (United States), 25-29 May 1992). In *Beams 92: Proceedings: Volume 3, Microwaves, Free electron lasers, Advanced accelerators, Applications, and Plasma discharges.* 681p. Order Number DE94014785. Source: OSTI; NTIS; INIS.

The authors executed experiments with a single-step vacuum accelerating cavity driven by injection of an annular 1-MA, 10^{14}-A/s, 1.5-MeV electron beam. They successfully accelerated a co-injected load beam through the magnetically insulated 50-MV/m gap (average gradient of >5 MeV/m). The load beam was transported through the accelerator with a passive grid system.

28140 (FNAL/C–94/191) **Xwake 1.0: A new tool for wakefield and impedance calculations.** Jurgens, T.G.; Saewert, G.W.; Harfoush, F.A. Fermi National Accelerator Lab., Batavia, IL (United States). Jul 1994. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH03000. (CONF-940618–20: 4. European particle accelerator conference, London (United Kingdom), 27 Jun - 1 jul 1994). Order Number DE94015545. Source: OSTI; NTIS; GPO Dep.

Xwake, a user friendly Finite Difference Time Domain (FDTD) code for wakefield and impedance calculations of rotationally symmetric structures is described. Contrary to the traditional stepped edge or half cell approach used in other codes, Xwake 1.0 incorporates the contour modeling approach allowing it to accurately represent curved boundaries. Other features include a mesh generator that allows for the handling of lossy materials, dielectrics, and ferrites, modeling of regions that are simply or multiply connected and automatic dynamic memory management. Xwake 1.0 is a fully integrated interactive code and is distributed free of charge. Xwake is written in ANSI-C for portability and has been demonstrated to run on several Unix platforms. A graphical user interface (GUI) allows easy access to all the processing modules in the code. The GUI uses the OSF/Motifl.1 widget set and the X11R4 window system. Simulation results emphasizing its capabilities, in particular for a very slowly tapered beam pipe, are presented.

28141 (GANIL-P–94-03) **Isotopic ultrapurification by magnetic-electric fields combination. LISE complex.** Anne, R. Grand Accelerateur National d'Ions Lourds (GANIL), 14 - Caen (France). 1994. 8p. (CONF-9310298–: International workshop on

radioactive nuclear beams produced by fragment-separation techniques, Varna (Bulgaria), 12-15 Oct 1993). Order Number DE94632519. Source: OSTI; NTIS (US Sales Only); INIS.

Selection of exotic nuclei or purification of secondary beams produced by the interaction with thick targets of high energy and high intensity heavy ion-beams delivered by the two stage cyclotron accelerator has been a challenge at GANIL. Physics on exotic nuclei at LISE and SPEG, mainly towards heavier masses, is in progress. This program is overviewed briefly. A new secondary beam production facility called SISSI delivering beams all over the experimental areas is going to be started at the beginning of 1994. (R.P.) 5 refs., 9 figs.

28142 (KEK-PROC–93-7, pp. 84-88) **Peripheral collisions in KEK B-factory.** Hirata, Kohji (National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan)). National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan). Jun 1993. (CONF-9211172–: International workshop on B factories: accelerators and experiments, Tsukuba (Japan), 17-20 Nov 1992). In *Proceedings of international workshop on B-factories: accelerators and experiments (BFWS92).* 435p. Order Number DE94737962. Source: OSTI; NTIS; INIS.

The smallest necessary value of the horizontal crossing angle is evaluated for the case where all buckets are filled with bunches and beams can interact not only at the central collision point but also at peripheral collision points. Half crossing angle of 5 mrad or a little less seems acceptable both for beam collision and for injection. Further enlargement of the crossing angle is not useful. Because of the emittance growth in injection, it is also useless that the vertical injection emittance is made less than 400 x nominal value. The consideration is based on both the strong-strong rigid Gaussian model and the weak-strong multiparticle tracking. (author).

28143 (KEK-PROC–93-7, pp. 89-93) **Fourier analysis of high order coherent and incoherent resonances in beam-beam interaction. 1: Incoherent spectroscopy.** Orlov, Y. (Cornell Univ., Ithaca, NY (United States). Newman Lab. of Nuclear Studies); Sofer, A. National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan). Jun 1993. (CONF-9211172–: International workshop on B factories: accelerators and experiments, Tsukuba (Japan), 17-20 Nov 1992). In *Proceedings of international workshop on B-factories: accelerators and experiments (BFWS92).* 435p. Order Number DE94737962. Source: OSTI; NTIS; INIS.

In this paper we describe how to find the approximate differential equation for particle movement using the information based on the spectroscopy of beam-beam interaction. Such an equation, different for different beam parameters, can be used, in particular, for the calculation of the beam 'incoherent' lifetime. This general program has not yet been implemented. (author).

28144 (KEK-PROC–93-7, pp. 94-117) **Collective issues related to B-factories.** Pestrikov, D.V. (National Lab. for High Energy Physics Tsukuba Ibaraki (Japan)). National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan). Jun 1993. (CONF-9211172–: International workshop on B factories: accelerators and experiments, Tsukuba (Japan), 17-20 Nov 1992). In *Proceedings of international workshop on B-factories: accelerators and experiments (BFWS92).* 435p. Order Number DE94737962. Source: OSTI; NTIS; INIS.

This report reviews the limitations on the performance of the planned B- and Φ-factories due to the collective interactions of stored bunches. Together with the traditional revision of the limitations due to the single- and multi-bunch interaction with surrounding electrodes, we briefly discuss in this report the limitations on the performance due to collective beam-beam instabilities of colliding beams and instabilities due to the collective interaction of beams with the ions. (author).

28145 (KEK-PROC–93-7, pp. 221-228) **Beam behaviour and luminosity upgrades in BEPC.** Zhang Chuang (Inst. of High Energy Physics, Berjing, BJ (China)). National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan). Jun 1993. (CONF-9211172–: International workshop on B factories: accelerators and experiments, Tsukuba (Japan), 17-20 Nov 1992). In *Proceedings of international workshop on B-factories: accelerators and experiments (BFWS92).* 435p. Order Number DE94737962. Source: OSTI; NTIS; INIS.

The Beijing Electron-Positron Collider (BEPC) has operated stably and progressively with its smooth improvement since the first e^-e^+ collision of 1988. The maximum luminosity reaches 8.2×10^{30} $cm^{-2}s^{-1}$ at the energy of 2.015 GeV, which is about the design value. The status and the operational experience over the past four years are summarized in this paper. The beam behaviour, concerning the single particle motion, single beam phenomena, and beam-beam effects and others is described. The future improvement on luminosity upgrades is presented. (author).

28146 (KEK-PROC–93-7, pp. 235-238) **Recent IR design work for the KEK B factory.** Satoh, Kotaro (National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan)). National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan). Jun 1993. (CONF-9211172–: International workshop on B factories: accelerators and experiments, Tsukuba (Japan), 17-20 Nov 1992). In *Proceedings of international workshop on B-factories: accelerators and experiments (BFWS92).* 435p. Order Number DE94737962. Source: OSTI; NTIS; INIS.

This paper presents the small angle collision scheme which stands between the head-on collision and the finite angle collision using with crab cavities. With this small angle both the synchro-betatron resonance effect, due to the beam collision at IP, and the parasitic crossing effect are expected to be weak. (author).

28147 (TRI-PP–91-15) **Stationary longitudinal phase space distributions with space charge.** Baartman, R. TRIUMF, Vancouver, BC (Canada). May 1991. 3p. (CONF-910505–: 1991 Institute of Electrical and Electronics Engineers (IEEE) particle accelerator conference (PAC), San Francisco, CA (United States), 6-11 May 1991). Order Number DE94632520. Source: OSTI; NTIS (US Sales Only); INIS.

An iterative technique has been employed to find longitudinal phase space distributions which are stationary under the influence of a constant, imaginary Z/n. In the positive mass regime (where Im(Z/n) is positive below transition or negative above transition), the main result is that, irrespective of the starting distribution, as the intensity is raised, the distribution tends towards one which has a parabolic line density. Since the locally elliptic distribution already has a parabolic projection, it is always stationary. In the negative mass regime, where the impedance augments the longitudinal focusing, centrally peaked stationary distributions cease to exist beyond a certain threshold intensity. In this regime, the limiting line density is also a parabola but one which is of opposite sign, i.e. with minimum density at the centre. (Author) 7 refs., 3 figs.

28148 (TRI-PP–91-16) **Bunched beam longitudinal stability.** Baartman, R. TRIUMF, Vancouver, BC (Canada). May 1991. 3p. (CONF-910505–: 1991 Institute of Electrical and Electronics Engineers (IEEE) particle accelerator conference (PAC), San Francisco, CA (United States), 6-11 May 1991). Order Number DE94632521. Source: OSTI; NTIS (US Sales Only); INIS.

Instabilities driven by narrow-band impedances can be stabilized by Landau damping arising from the synchrotron frequency spread due to the nonlinearity of the rf wave-form. We calculate stability diagrams for various phase space distributions. We find that distributions without tails are unstable in the 'negative mass' regime (inductive impedance below transition or capacitive impedance above transition). We also find that longitudinal instability thresholds of the (usually neglected) higher order radial modes are lower than expected. For example, the next to lowest dipole mode has a lower threshold than the lowest sextupole mode even though the latter has the larger growth rate in the absence of Landau damping. (Author) 5 refs., 5 figs.

28149 (TRI-PP–91-23) **Simulation of hollow beams with cancellation of steady state non-linear space-charge.** Koscielniak, S.R. TRIUMF, Vancouver, BC (Canada). May 1991. 3p. (CONF-910505–: 1991 Institute of Electrical and Electronics Engineers (IEEE) particle accelerator conference (PAC), San Francisco, CA (United States), 6-11 May 1991). Order Number DE94632522. Source: OSTI; NTIS (US Sales Only); INIS.

This paper describes a technique for making multiparticle computer simulations of coherent instability consistent with conventional bunched-beam longitudinal instability theory. The argument behind the technique exposes an oversight of instability theory: the response of the phase-space distribution to the non-linear steady

state wakefields is neglected. As an example, the technique is applied to a beam with the steady-state space-charge fields artificially cancelled. The computer simulations presented are seen to agree with mode-coupling theory. Beam and machine parameters are taken from the proposed TRIUMF-KAON Accumulator, which is a high current proton storage ring. (Author) 5 refs., 4 figs., tab.

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Refer also to citation(s) 28035, 28054, 28055, 28056, 28057, 28058, 28059, 28060, 28061, 28063, 28064, 28065, 28069, 28124, 28270, 28273, 28275, 28284, 28301, 28322, 28324, 28341, 28877

28150 (ANL/APS/TB–18) **The cryogenic cooling program at the Advanced Photon Source.** Rogers, C.S.; Mills, D.M.; Assoufid, L. Argonne National Lab., IL (United States). Jun 1994. 22p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. Order Number DE94015817. Source: OSTI; NTIS; INIS; GPO Dep.

This paper describes the experimental and analytical program in cryogenic cooling of high-heat-load optics at the Advanced-Photon Source. A prototype liquid nitrogen pumping system has been procured. This pump provides a variable flow rate of 1 to 10 gpm of pressurized liquid nitrogen and is sized to handle up to 5 kW of optic heat load. Also, a high-vacuum, double-crystal monochromator testing tank has been fabricated. This system will be used to test cryogenic crystals at existing synchrotron sources. A finite element analysis has been performed for a cryogenically cooled Si crystal in the inclined geometry for Undulator A at 100 mA. The inclination angle was 80°. It was set to diffract from the (111) planes at the first harmonic energy of 4.2 keV. The maximum slope error in the diffraction plane was calculated to be about 1 μrad with a peak temperature of 94 K. An analysis has also been performed for a cryogenically-cooled "thin" crystal oriented in the Bragg geometry which accepts 87% of the lst harmonic photons at 3.866 keV. The total absorbed power was 131 W at 100 mA current and the peak temperature was 124 K.

28151 (ANL/ASD/CP–81728) **Development of GUS for control applications at the Advanced Photon Source.** Chung, Y.; Barr, D.; Borland, M.; Kirchman, J.; Decker, G.; Kim, K. Argonne National Lab., IL (United States). [1994]. 3p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-940618–27: 4. European particle accelerator conference, London (United Kingdom), 27 Jun - 1 jul 1994). Order Number DE94016307. Source: OSTI; NTIS; INIS; GPO Dep.

A script-based interpretive shell GUS (General Purpose Data Acquisition for Unix Shell) has been developed for application to the Advanced Photon Source (APS) control. The primary design objective of GUS is to provide a mechanism for efficient data flow among modularized objects called Data Access Modules (DAMs). GUS consists of four major components: user interface, kernel, built-in command module, and DAMS. It also incorporates the Unix shell to make use of the existing utility programs for file manipulation and data analysis. At this time, DAMs have been written for device access through EPICS (Experimental Physics and Industrial Control System), data I/O for SDDS (Self-Describing Data Set) files, matrix manipulation, graphics display, digital signal processing, and beam position feedback system control. The modular and object-oriented construction of GUS will facilitate addition of more DAMs with other functions in the future.

28152 (ANL/ASD/CP–81729) **Summary test results of the particle-beam diagnostics for the Advanced Photon Source (APS) subsystems.** Lumpkin, A.; Wang, X.; Sellyey, W.; Patterson, D.; Kahana, E. Argonne National Lab., IL (United States). [1994]. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-940618–28: 4. European particle accelerator conference, London (United Kingdom), 27 Jun - 1 jul 1994). Order Number DE94016298. Source: OSTI; NTIS; INIS; GPO Dep.

During the first half of 1994, a number of the diagnostic systems for measurement of the charged-particle beam parameters throughout the subsystems of the Advanced Photon Source (APS) have been installed and tested. The particle beams eventually will involve 450-MeV to 7-GeV positrons and with different pulse formats. The first test and commissionin results for beam profiles, beam position monitors, loss rate monitors, current monitors, and synchrotron radiation photon monitors hve been obtained using 200- to 350-MeV electron beams injected into the subsystems. Data presented are principally from the transport lines and the positron accumulator ring.

28153 (ANL/ASD/CP–83412) **Electromagnetic field measurements on a mm-wave linear accelerator.** Matthews, P. (Argonne National Lab., IL (United States)); Kang, Y.; Berenc, T.; Kustom, R.; Willke, T.; Feinerman, A. Argonne National Lab., IL (United States). [1994]. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-940618–15: 4. European particle accelerator conference, London (United Kingdom), 27 Jun - 1 jul 1994). Order Number DE94015092. Source: OSTI; NTIS; INIS; GPO Dep.

Field strength measurements for the determination of the R/Q of a mm-wave, 50-MeV electron linear accelerator using perturbational techniques are described. The perturbation is achieved using optical fibers coated with a thin metallic film to form a hollow cylinder. The perturbational form factors for such a geometry are approximated using several simple analytical expressions which are compared to a finite difference calculation as well as experimental results on a known cavity.

28154 (ANL/ASD/CP–83489) **HOM damping with coaxial dampers in the storage ring cavities of the Advanced Photon Source.** Kang, Y.W.; Kustom, R.L. Argonne National Lab., IL (United States). [1994]. 3p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-940618–31: 4. European particle accelerator conference, London (United Kingdom), 27 Jun - 1 jul 1994). Order Number DE94016353. Source: OSTI; NTIS; INIS; GPO Dep.

Coaxial dampers with E-probe and H-loop couplers are used to damp higher-order modes (HOM) in a 352-MHz single cell cavity for the storage ring of the Advanced Photon Source (APS). Measurements have been made with three different types of dampers such as E-probe dampers, small H-loop dampers, and H-loop dampers with $\lambda/4$ short stub. Two dampers are used in each type. The dampers without fundamental frequency rejection filters are positioned to have a minimum deQing at the fundamental frequency: the E-probe dampers are used at the equatorial plane of the cavity, and the small H-loop dampers are used in the end wall of the cavity. The fundamental mode decoupling can be done by positioning the loop plane in the direction of the H-field of the mode.

28155 (ANL/ASD/CP–83492) **Longitudinal coupling impedance of a bellows and a ceramic gap in a circular beam pipe for the Advanced Photon Source.** Song, J.J.; Zhou, J.; Matthews, P.J. Argonne National Lab., IL (United States). [1994]. 3p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-940618–32: 4. European particle accelerator conference, London (United Kingdom), 27 Jun - 1 jul 1994). Order Number DE94016354. Source: OSTI; NTIS; INIS; GPO Dep.

Longitudinal beam coupling impedances of a bellows and a ceramic gap in a circular beam pipe were measured using a TSD/TRL/LRL calibration. The calibration was implemented on a 486PC running LabWindows. The formulae for error matrix determination and measured Sparameter de-embedding were derived and verified. Hardware standards for 1.5-inch circular beam pipe were made and tested. Standards for elliptical beam pipe and other pipe radii for the Advanced Photon Source (APS) storage ring components are being designed. The measured impedances indicate that the ceramic pipe is purely capacitive.

28156 (ANL/ASD/CP–83555) **Numerical simulation of waveguide input/output couplers for a planar mm-wave linac cavity.** Kang, Y.W. Argonne National Lab., IL (United States). [1994]. 3p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-940618–29: 4. European particle accelerator conference, London (United Kingdom), 27 Jun - 1 jul 1994). Order Number DE94016304. Source: OSTI; NTIS; INIS; GPO Dep.

A double-sided planar mm-wave linear accelerating cavity structure has been studied. The input/output couplers for the accelerating cavity structure have been designed using the Hewlett-Packard High Frequency Structure Simulator (HFSS). The program is a frequency domain finite element 3-D field solver and can include matched port boundary conditions. The power transmission property of the structure is calculated in the frequency domain. The dimensions of the, coupling cavities and the irises at the input/output ports are adjusted to have the structure matched to rectangular waveguides. The field distributions in the accelerating structure for the $2\pi/3$-mode traveling wave are shown.

28157 (ANL/ASD/CP–83663) **Fabrication and measurement of a 10× scale model of a double-sided planar mm-wave linac cavity structure.** Kang, Y.W.; Matthews, P.; Nassiri, A.; Kustom, R.L. Argonne National Lab., IL (United States). [1994]. 3p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-940618–33: 4. European particle accelerator conference, London (United Kingdom), 27 Jun - 1 jul 1994). Order Number DE94016381. Source: OSTI; NTIS; INIS; GPO Dep.

A double-sided planar mm-wave linear accelerating cavity, structure has been investigated. An 80-cell constant impedance structure working with $2\pi/3$-mode traveling wave was chosen as an accelerator section. A 10x scale model of the structure has been fabricated and the basic electrical performances have been tested. The nodal shift measurement technique with a rectangular detuning plunger was used to measure the phase advance between the cells with a vector network analyzer.

28158 (ANL/PHY/CP–83505) **Laser-driven polarized targets of hydrogen and deuterium.** Jones, C.E.; Coulter, K.P.; Holt, R.J.; Kowalczyk, R.S.; O'Neill, T.G.; Poelker, M.; Zeidman, B. Argonne National Lab., IL (United States). [1994]. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-940514–6: Intersections of particle and nuclear physics, St. Petersburg, FL (United States), 31 May - 6 jun 1994). Order Number DE94016314. Source: OSTI; NTIS; INIS; GPO Dep.

An optical pumping technique used in a laser-driven source of polarized hydrogen or deuterium is described and measurements of the achievable polarization as a function of flow for both hydrogen and deuterium are presented. Ongoing tests of the feasibility of using a laser-driven polarized deuterium source coupled to a storage cell as a polarized internal target, including direct measurements of the nuclear polarization, are discussed.

28159 (ANL/XFD/CP–82780) **Performance of spherically focusing Ge(444) backscattering analyzers for inelastic x-ray scattering.** Macrander, A.T.; Kushnir, V.I.; Blasdell, R.C. Argonne National Lab., IL (United States). [1994]. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-940714–1: International meeting on synchrotron radiation instrumentation, Stony Brook, NY (United States), 18-22 Jul 1994). Order Number DE94016349. Source: OSTI; NTIS; INIS; GPO Dep.

A spectrometer designed to use an undulator source and having targeted resolutions of 0.01 eV in one mode of use and 0.2 eV in another will operate at the APS. We report here on analyzers that we have, constructed for use on this spectrometer for 0.2-eV resolution. We have tested them at NSLS beamline X21 using focused wiggler radiation and at CHESS using radiation from the CHESS-ANL undulator. Analyzers were constructed by gluing and pressing 90-mm-diameter, (111) oriented Ge wafers into concave glass forms having a radius near 1 m. An overall inelastic scattering resolution of 0.3 eV using the (444) reflection was demonstrated at CHESS. Recent results at X21 revealed a useful diameter of 74 mm at an 870 Bragg angle.

28160 (BNL–60465) **Modeling of the cluster klystron solenoid.** Kirk, H.G. Brookhaven National Lab., Upton, NY (United States). 29 Jun 1993. 12p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH00016. Order Number DE94016795. Source: OSTI; NTIS; INIS; GPO Dep.

The code POISSON is used to determine the longitudinal extent of the good field region of the cluster klystron solenoid. The field shape as a function of end-coil current enhancements is determined.

28161 (BNL–60544) **Possible application of an EBIS in preinjectors for large heavy ion colliders.** Haseroth, H. (European Organization for Nuclear Research, Geneva (Switzerland)); Prelec, K. Brookhaven National Lab., Upton, NY (United States). [1994]. 21p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH00016. (CONF-9406180–3: 6. international symposium on electron beam ion sources and their applications, Stockholm (Sweden), 20-23 Jun 1994). Order Number DE94015847. Source: OSTI; NTIS; INIS; GPO Dep.

High energy, heavy ion nuclear physics has so far been limited to experiments with a fixed target. Presently there are two projects that would greatly extend the available collision energy: the Relativistic Heavy Ion Collider (RHIC) under construction at Brookhaven National Laboratory (BNL), and the Large Hadron Collider (LHC) planned at CERN. While RHIC was from the very beginning designed for collisions of all heavy ions up to gold, LHC was initially considered as a p-p and, perhaps eventually, an e-p collider, with the heavy ion option added at a later stage; this option is now included in the planning right from the beginning. The present RHIC scenario for acceleration of gold ions starts with the BNL Tandem injecting Au^{14+} ions into the Booster; after acceleration ions are stripped to a charge state of 77+, injected into the AGS, stripped again to 79+ and injected into RHIC, with three bunches per cycle. The LHC scenario for acceleration of lead ions will use as the injector the CERN Heavy Ion Facility: production of ions in a charge state around 27+ in an ECR ion source, followed by an RFQ/linac combination, stripping to Pb^{53+} at 4.2 MeV/u, acceleration in the PSB and PS, stripping to the state 82+, and acceleration in the SPS. There would be 144 bunches injected into the LHC per SPS cycle. However, the resulting luminosity would be rather low and several accumulating schemes are being considered as well. In this paper we are considering a next-generation EBIS device as a possible substitution for ion sources in the preinjector stages of the two colliders with the objective of achieving an improved performance.

28162 (BNL–60554) **EBIS option for the relativistic heavy ion collider - RHIC.** Prelec, K.; Alessi, J.; Hershcovitch, A. Brookhaven National Lab., Upton, NY (United States). [1994]. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH00016. (CONF-940618–22: 4. European particle accelerator conference, London (United Kingdom), 27 Jun - 1 jul 1994). Order Number DE94015841. Source: OSTI; NTIS; INIS; GPO Dep.

The present RHIC scenario for acceleration of gold ions starts with the BNL Tandem injecting Au^{14+} ions in to the Booster. As a future alternative to the Tandem and its 840 m transfer line to the Booster, the authors are considering an EBIS followed by an RFQ and a short linac. Such a preinjector should be capable of delivering ions of any species up to uranium, with intensities as required by RHIC. This paper will first present a short review of the state-of-the-art of intense EBIS devices, followed by an estimate of parameters of a source for RHIC and BNL. The authors plan to proceed in two phases, first to develop a device with an electron beam current of 1-2 A to serve as a feasibility test, and then to continue with the design of the final device. The second part of the paper will describe an RFQ and a linac for ions with a charge-to-mass ratio of about 0.18. Finally, the authors mention a scheme to inject in a fast sequence up to four pulses into the Booster, running in an accumulating mode.

28163 (BNL–60586) **Neural networks and orbit control in accelerators.** Bozoki, E.; Friedman, A. Brookhaven National Lab., Upton, NY (United States). [1994]. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH00016. (CONF-940618–9: 4. European particle accelerator conference, London (United Kingdom), 27 Jun - 1 jul 1994). Order Number DE94014877. Source: OSTI; NTIS; INIS; GPO Dep.

An overview of the architecture, workings and training of Neural Networks is given. We stress the aspects which are important for the use of Neural Networks for orbit control in accelerators and storage rings, especially its ability to cope with the nonlinear behavior of the orbit response to 'kicks' and the slow drift in the orbit response during long-term operation. Results obtained for the two NSLS storage rings with several network architectures and various training methods for each architecture are given.

28164 (BNL–60604) **RHIC off-line computing.** Featherly, J. (and others); Gibbard, B.; Gould, J. Brookhaven National Lab., Upton, NY (United States). 30 Jun 1993. 17p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH00016. Order Number DE94015826. Source: OSTI; NTIS; INIS; GPO Dep.

A report was prepared in Sept 1992, RHIC/DET Note 8, also known as ROCOCO, which estimated the various computing resources which will be required by the RHIC experimental program. A study has now been undertaken to review technical issues associated with supplying these resources. This study, organized by the HEP/NP Computing Group but including other appropriate participants, addresses questions of technologies, manpower, cost and schedule. The following document is an interim summary of this study both in terms of discussions which have occurred and initial conclusions reached.

28165 (BUDKERINP–93-72) **The simple model of the supermodes in FEL with a intracavity etalon.** Popik, V.M.; Vinokurov, N.A. AN SSSR, Novosibirsk (Russian Federation). Inst. Yadernoj Fiziki. 1993. 9p. (IYaF–93-72.). Order Number DE94632545. Source: OSTI; NTIS (US Sales Only); INIS.

The influence of intracavity glass plate with parallel planes on characteristics of FEL is theoretically investigated. 4 refs.

28166 (CEA-CONF–11697) **Integrated devices for single picosecond pulse measurements.** Gerbe, V.; Cuzin, M.; Gentet, M.C.; Lajzerowicz, J. CEA Centre d'Etudes de Grenoble, 38 (France). Direction des Technologies Avancees. 1992. 2p. (CONF-9206451–: Ultrafast phenomena, Antibes-Juan-les-Pins (France), 8-12 Jun 1992). Order Number DE94632556. Source: OSTI; NTIS (US Sales Only); INIS.

An optoelectronic sampler was developed for the autocorrelator used as an X-ray monitor to measure the bunch length of the CERN synchrotron in Geneva. An extended application is the temporal measurement of single laser pulses. The device is made up with metallic strip lines combined with a fast photoconductor thin film. The structure and operation of the autocorrelator are described. (R.P.) 3 refs., 3 figs.

28167 (CEA-LNS-Ph–93-15) **Saturne: Present and future.** Bertini, R. Laboratoire National Saturne, Centre d'Etudes de Saclay, 91 - Gif-sur-Yvette (France). 1993. 6p. (CONF-921131–: 10. international symposium on high-energy spin physics, Nagoya (Japan), 9-14 Nov 1992). Order Number DE94632557. Source: OSTI; NTIS (US Sales Only); INIS.

Some experiments in progress at Saturne and measuring spin observables in pp inelastic scattering are presented. The large values of the polarization of protons and deuterons made possible an extended program of measurement of spin observables, in the associated strangeness production of hyperons. Future perspectives are also discussed. (R.P.) 5 refs., 1 fig., 1 tab.

28168 (DOE/ER/14052–1) **High frequency CARM driver for RF linacs: Progress report, Year 1.** Danly, B.G. Massachusetts Inst. of Tech., Cambridge, MA (United States). 15 May 1990. 53p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-89ER14052. Order Number DE94016492. Source: OSTI; NTIS; INIS; GPO Dep.

Progress during the first year of this program has been noteworthy in both theoretical and experimental areas. Substantial improvements to the MIT CARM codes have been carried out, and the code has been successfully benchmarked against other codes, linear theory, and experimental work. CARM amplifier phase stability has been studied theoretically and found to be significantly better than that of free-electron lasers or relativistic klystrons, provided the device is properly designed. Both multimode simulations and particle-in-cell simulations have been carried out to study mode competition effects between convectively unstable and absolutely unstable modes. Improvement of the Pierce-Wiggler code for modeling the beam formation prior to the interaction region has been carried out. Experimental designs for a long-pulse, modulator-driven CARM amplifier experiment which will be carried out by the end of this fiscal year have been mostly completed. Designs for an induction-linac-driven CARM amplifier experiment, which will be carried out by the end of Year II of this program,, have also been performed. Finally, a CARM oscillator experiment is presently underway at our facility.

28169 (DOE/ER/40759–2) **Theoretical problems in accelerator physics: Progress report.** California Univ., San Diego, CA (United States). [1994]. 25p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG03-93ER40759. Order Number DE94017150. Source: OSTI; NTIS; INIS; GPO Dep.

This is the second progress report submitted under the author's current grant and covers progress made since the submission of the first progress report in August 1993. During this period the author has continued to spend approximately one half of his time at SLAC and most of the projects reported here were carried out in collaboration with individuals and groups at SLAC. Except where otherwise noted, reference numbers in the text refer to the attached list of current contract publications. Copies of the publications, numbered in agreement with the publication list, are included with this report.

28170 (DOE/ER/54160–1-Vol.3, pp. 1449-1454) **Optimization of the output cavity for a three cavity X-band gyroklystron amplifier.** Main, W. (Univ. of Maryland, College Park, MD (United States)); Tantawi, S.; Latham, P.E.; Hogan, B.; Lawson, W.; Striffler, C.D.; Granatstein, V.L. Maryland Univ., College Park, MD (United States). [1992]. (CONF-920515–Vol.3: 9. international conference on high power particle beams, Washington, DC (United States), 25-29 May 1992). In *Beams 92: Proceedings: Volume 3, Microwaves, Free electron lasers, Advanced accelerators, Applications, and Plasma discharges.* 681p. Order Number DE94014785. Source: OSTI; NTIS; INIS.

Experimental results of the Univ. of Maryland three-cavity gyroklystron indicate that interactions past the output cavity have enhanced the tube's efficiency. The tube operated at 10 GHz in the TE_{01} mode. At beam parameters of 425 kV, 204 A, and α=0.7, the three-cavity gyroklystron produced 27 MW at 32% efficiency with gain of 36 dB and pulse energy of 39 J. Four different three-cavity circuits were studied experimentally. These circuits differed mainly in the geometry of the output cavity. Each of these circuits was found to have two distinct operating regimes, which were controlled by the magnetic guide field taper across the circuit. By observing the effects of perturbing the guide field after the output cavity; and using an electric field probe in the output cavity it is shown that one regime corresponds to a CARM-like interaction after the output cavity.

28171 (DOE/ER/54160–1-Vol.3, pp. 1455-1460) **Theoretical investigation of anomalously high efficiency in a three cavity gyroklystron amplifier.** Latham, P.E. (Univ. of Maryland, College Park, MD (United States)); Koc, U.V.; Main, W.; Tantawi, S.G. Maryland Univ., College Park, MD (United States). [1992]. (CONF-920515–Vol.3: 9. international conference on high power particle beams, Washington, DC (United States), 25-29 May 1992). In *Beams 92: Proceedings: Volume 3, Microwaves, Free electron lasers, Advanced accelerators, Applications, and Plasma discharges.* 681p. Order Number DE94014785. Source: OSTI; NTIS; INIS.

The University of Maryland's three cavity gyroklystron amplifier operating at a frequency of 10 GHz, voltage of 425 kV, current of 160 A, and pitch angle ($v_\perp/v_z$) near .82, has demonstrated an efficiency of 35%. The author's simulations using fixed field profiles predict a significantly lower efficiency, primarily because of the small pitch angle in the experiment. They will be investigating two methods of improving the efficiency in their simulations: Beam-wave interaction after the output cavity, and modification of the first two cavity Qs due to beam loading. Results of their nonlinear code will be given for both cases.

28172 (DOE/ER/54160–1-Vol.3, pp. 1461-1466) **High efficiency, low magnetic field gyroklystron amplifiers.** Latham, P.E. (Univ. of Maryland, College Park, MD (United States)); Nusinovich, G.S.; Levush, B. Maryland Univ., College Park, MD (United States). [1992]. (CONF-920515–Vol.3: 9. international conference on high power particle beams, Washington, DC (United States), 25-29 May 1992). In *Beams 92: Proceedings: Volume 3,*

Microwaves, Free electron lasers, Advanced accelerators, Applications, and Plasma discharges. 681p. Order Number DE94014785. Source: OSTI; NTIS; INIS.

The possibility of operating a gyroklystron amplifier at high efficiency and low magnetic field is considered. Two devices are discussed: A two cavity second harmonic TE_{02} gyroklystron amplifier operating at 19.7 GHz with subharmonic bunching, and a fundamental mode TE_{01} gyrotwistron at 16 GHz. The nonlinear efficiency is given for both devices.

28173 (DOE/ER/54160–1-Vol.3, pp. 1467-1472) **Mode-primed operation of an 85 GHz quasioptical gyroklystron.** Fischer, R.P. (Naval Research Lab., Washington, DC (United States)); Fliflet, A.W.; Manheimer, W.M. Maryland Univ., College Park, MD (United States). [1992]. (CONF-920515–Vol.3: 9. international conference on high power particle beams, Washington, DC (United States), 25-29 May 1992). In *Beams 92: Proceedings: Volume 3, Microwaves, Free electron lasers, Advanced accelerators, Applications, and Plasma discharges.* 681p. Order Number DE94014785. Source: OSTI; NTIS; INIS.

The quasioptical gyrotron (QOG) is currently under development at the US Naval Research Lab. as a high power source of millimeter-wave radiation. A quasioptical gyroklystron configuration has recently been realized by the addition of an open-mirror prebunching resonator driven by an 85 GHz, 1.5 kW extended interaction oscillator (EIO). The experiment is designed to operate at a voltage of 70 kV and beam currents of 5-15 A. The experiment is currently in progress, and results are presented for EIO mode priming and depressed collector operation at powers up to 100 kW. A technique for increasing the efficiency by adjusting the electron beam parameters on the rise of the voltage pulse is also described.

28174 (DOE/ER/54160–1-Vol.3, pp. 1473-1478) **Large orbit gyroklystron development at Los Alamos.** Stringfield, R.M. (Los Alamos National Lab., NM (United States)); Wheat, R.M.; Brown, D.J.; Fazio, M.V.; Kinross-Wright, J.; Carlsten, B.E.; Rodenz, G.; Faehl, R.J.; Hoeberling, R.F. Maryland Univ., College Park, MD (United States). [1992]. (CONF-920515–Vol.3: 9. international conference on high power particle beams, Washington, DC (United States), 25-29 May 1992). In *Beams 92: Proceedings: Volume 3, Microwaves, Free electron lasers, Advanced accelerators, Applications, and Plasma discharges.* 681p. Order Number DE94014785. Source: OSTI; NTIS; INIS.

The authors have designed and are testing a large orbit gyroklystron amplifier for 1.3 GHz operation in 70 ns pulses. The ultimate power output goal is 500 MW with a gain in excess of 20 dB. This initial investigation is intended to lay the groundwork for operation at 11.4 GHz for particle accelerator applications, and also at frequencies of up to 35 GHz for other uses. Computational design has been performed with the resonant cavity code MAFIA and the particle in cell codes MERLIN and ISIS. Experimental measurements of the resonator modes were correlated with computational and analytical predictions. Electron beam optics through a magnetic cusp was also studied with ISIS and MERLIN and verified experimentally, to develop a suitable electron beam trajectory from the diode into the resonator region. Performance tests of a single state device have just begun. The device is intended in its final form to use two resonators separated by an electron beam drift pipe.

28175 (DOE/ER/54160–1-Vol.3, pp. 1479-1484) **The NRL 11.4 GHz magnicon amplifier experiment.** Gold, S.H. (Naval Research Lab., Washington, DC (United States)); Sullivan, C.A.; Hafizi, B.; Manheimer, W.M.; Black, W.M. Maryland Univ., College Park, MD (United States). [1992]. DOE Contract AI05-91ER40638. (CONF-920515–Vol.3: 9. international conference on high power particle beams, Washington, DC (United States), 25-29 May 1992). In *Beams 92: Proceedings: Volume 3, Microwaves, Free electron lasers, Advanced accelerators, Applications, and Plasma discharges.* 681p. Order Number DE94014785. Source: OSTI; NTIS; INIS.

The authors present a progress report on a program to develop a high-power X-band magnicon amplifier for accelerator applications. The goal of the program is to generate 50 MW at 11.4 GHz with 50% efficiency, using a 200 A, 500 keV electron beam produced by a cold-cathode diode on the NRL Long-Pulse Accelerator Facility. The initial experiment, designed to study the gain from the first (driven) deflection cavity to a second (passive) deflection cavity, has recently begun.

28176 (DOE/ER/54160–1-Vol.3, pp. 1485-1490) **High performance 33.2 GHz gyroklystron.** McNally, J.D. (Univ. of California, Los Angeles, CA (United States)); Bobys, M.P.; McDermott, D.B.; Luhmann, N.C. Jr. Maryland Univ., College Park, MD (United States). [1992]. Contract DAAL03-91-C-0190; Contract F30602-91-C-0020. (CONF-920515–Vol.3: 9. international conference on high power particle beams, Washington, DC (United States), 25-29 May 1992). In *Beams 92: Proceedings: Volume 3, Microwaves, Free electron lasers, Advanced accelerators, Applications, and Plasma discharges.* 681p. Order Number DE94014785. Source: OSTI; NTIS; INIS.

The design for a high performance, 33.2 GHz three-cavity gyroklystron has been completed. The design modifies Varian's pioneering 28 GHz gyroklystron in order to suppress oscillation and yield higher gain and efficiency. Modifications include an additional buncher cavity, lower beam α, and a slight increase in frequency. Self-consistent simulation for an axial velocity spread of 7% and α = 1.5 predicts an output power of 250 kW with a saturated gain of 52 dB and an efficiency of 39%. An investigation of penultimate cavity detuning showed no improvement in efficiency for the above velocity spread. A synchronously tuned gyroklystron is currently being constructed.

28177 (DOE/ER/54160–1-Vol.3, pp. 1491-1496) **Harmonic gyro-TWT amplifier for high power.** Wang, Q.S. (Univ. of California, Los Angeles, CA (United States)); McDermott, D.B.; Luhmann, N.C. Jr.; Lin, A.T.; Kou, C.S.; Chu, K.R. Maryland Univ., College Park, MD (United States). [1992]. Contract DAAL003-91-G-0190. (CONF-920515–Vol.3: 9. international conference on high power particle beams, Washington, DC (United States), 25-29 May 1992). In *Beams 92: Proceedings: Volume 3, Microwaves, Free electron lasers, Advanced accelerators, Applications, and Plasma discharges.* 681p. Order Number DE94014785. Source: OSTI; NTIS; INIS.

An extremely high power, second harmonic TE_{21} gyrotron traveling wave amplifier (gyro-TWT) utilizing a MIG beam will be described. Based on a marginal stability procedure, a second harmonic gyro-TWT using a 100 kV, 25 A MIG beam with α = 1 and $\delta v_z/v_z$ = 5% has been designed, where the total interaction tube is comprised of three sections separated by absorbing severs. The length of each section is shorter than the length at which the device will spontaneously oscillate, which is determined through a combination of analytical theory and multi-mode PIC code simulation. The number of sections is chosen to yield the desired gain. An output power of 500 kW, efficiency of 21% and bandwidth of 7% have been obtained through self-consistent nonlinear simulations for the designed amplifier.

28178 (DOE/ER/54160–1-Vol.3, pp. 1497-1502) **Stability and nonlinear dynamics of gyrotrons at cyclotron harmonics.** Saraph, G.P. (Univ. of Maryland, College Park, MD (United States)); Nusinovich, G.S.; Antonsen, T.M. Jr.; Levush, B. Maryland Univ., College Park, MD (United States). [1992]. (CONF-920515–Vol.3: 9. international conference on high power particle beams, Washington, DC (United States), 25-29 May 1992). In *Beams 92: Proceedings: Volume 3, Microwaves, Free electron lasers, Advanced accelerators, Applications, and Plasma discharges.* 681p. Order Number DE94014785. Source: OSTI; NTIS; INIS.

Gyrotrons operating at higher harmonics of the cyclotron frequency can overcome the frequency limitations caused by achievable strength of the magnetic field. However, the excitation of modes at the fundamental frequency exhibit a major problem for stable operation of harmonic gyrotron at high power with high efficiency. Therefore the issues of stability of gyrotron operation at the cyclotron harmonics and nonlinear dynamics of mode interaction are of great importance. The results of the authors stability analysis and multimode simulation are presented here. A detailed nonlinear theory of steady state single mode operation at cyclotron harmonics has been presented previously, taking into account beam-wave coupling and nonlinear gain function at cyclotron harmonics. A set of equations describing low gain regime interaction of modes resonant at different cyclotron harmonics was studied before. The multifrequency time-dependent nonlinear analysis presented here

is based on previous gyrotron studies and beam-wave interaction at cyclotron harmonics. The authors have determined the parameter space for stable single mode operation at the second harmonic. The nonlinear dynamics of mode evolution and mode interaction for a harmonic gyrotron is presented. A new nonlinear effect in which the parasite at the fundamental harmonic helps excite the operating mode at the second harmonic has been demonstrated.

28179 (DOE/ER/54160–1-Vol.3, pp. 1503-1507) **Prospects for development of powerful, highly efficient, relativistic gyrodevices.** Nusinovich, G.S. (Univ. of Maryland, College Park, MD (United States)); Granatstein, V.L. Maryland Univ., College Park, MD (United States). [1992]. (CONF-920515–Vol.3: 9. international conference on high power particle beams, Washington, DC (United States), 25-29 May 1992). In *Beams 92: Proceedings: Volume 3, Microwaves, Free electron lasers, Advanced accelerators, Applications, and Plasma discharges.* 681p. Order Number DE94014785. Source: OSTI; NTIS; INIS.

For various applications the required parameters of sources of powerful microwave radiation lie far beyond the capabilities of existing tubes. This provokes an interest in reconsidering basic principles of relevant microwave sources in order to search for alternative concepts in their development. One of the most promising devices in the short-wavelength region of microwaves is the cyclotron resonance maser (CRM). During the last decade, two important varieties of CRMs have been distinguished, namely, gyrotrons, which operate at frequencies close to cut-off, and cyclotron autoresonance masers (CARMs), which operate at frequencies far from cut-off. When the axial phase velocity of the wave in properly adjusted to the beam voltage and electron pitch-ratio, the efficiency of relativistic CRMs may be high ($\geq$50%). The method of optimizing efficiency based on a partial compensation of the shift in the relativistic electron cyclotron frequency by the change in the Doppler term can be, in principle, accompanied by a corresponding profiling of the external magnetic field and/or the wave phase velocity in a slightly irregular waveguide. These methods can be used in such relativistic CRMs as relativistic gyrotrons, gyroklystrons, gyro-traveling-wave-tubes and gyrotwistrons. The most important point is their sensitivity to a spread in electron parameters. As the beam voltage grows, the operation becomes more sensitive. However, at relatively low voltages such devices are quite tolerant to electron velocity spread.

28180 (DOE/ER/54160–1-Vol.3, pp. 1508-1513) **Depressed collectors for millimeter wave gyrotrons.** Singh, A. (Univ. of Maryland, College Park, MD (United States)); Granatstein, V.L. Maryland Univ., College Park, MD (United States). [1992]. (CONF-920515–Vol.3: 9. international conference on high power particle beams, Washington, DC (United States), 25-29 May 1992). In *Beams 92: Proceedings: Volume 3, Microwaves, Free electron lasers, Advanced accelerators, Applications, and Plasma discharges.* 681p. Order Number DE94014785. Source: OSTI; NTIS; INIS.

The main issues relating to design of depressed collectors for millimeter wave gyrotrons are discussed. A flow diagram is presented and the interlinking steps are outlined. Design studies are given for two kinds of gyrotrons on which severe constraints on the maximum radii of the collectors had been imposed; namely, for a cavity type and a quasi-optical gyrotron. A collector efficiency of the order of 70 percent is shown to be feasible for either case using careful tailoring of magnetic field profiles. A code has been developed to assist in doing this. A general approach toward initial placement of collectors has been indicated.

28181 (DOE/ER/54160–1-Vol.3, pp. 1514-1519) **Coherent fast wave radiation from spatiotemporally modulated gyrating relativistic electron beams.** Hirshfield, J.L. (Omega-P, Inc., New Haven, CT (United States)); Ganguly, A.K. Maryland Univ., College Park, MD (United States). [1992]. (CONF-920515–Vol.3: 9. international conference on high power particle beams, Washington, DC (United States), 25-29 May 1992). In *Beams 92: Proceedings: Volume 3, Microwaves, Free electron lasers, Advanced accelerators, Applications, and Plasma discharges.* 681p. Order Number DE94014785. Source: OSTI; NTIS; INIS.

Generation of radiation is described at a harmonic of the rotation frequency for a spatiotemporally modulated gyrating electron beam. Cumulative energy flow into the wave occurs when its group velocity matches the beam's axial velocity. Fifth harmonic wave growth at 94 GHz in a cylindrical waveguide is shown to be relatively free of mode competition for a device employing a 150 kV, 6.7 A beam. Non-linear simulations show a saturated efficiency of 56% for a linear magnetic field taper in this device. The saturated efficiency only drops to 50% for an axial velocity spread of 10%.

28182 (DOE/ER/54160–1-Vol.3, pp. 1526-1531) **Cyclotron autoresonance maser (CARM) amplifier experiments at 17 GHz.** Menninger, W.L. (Massachusetts Institute of Technology, Cambridge, MA (United States)); Danly, B.G.; Alberti, S.; Chen, C.; Goodman, D.L.; Giguet, E.; Rullier, J.L.; Wurtele, J.S.; Temkin, R.J. Maryland Univ., College Park, MD (United States). [1992]. DOE Contract FG02-89ER14052. (CONF-920515–Vol.3: 9. international conference on high power particle beams, Washington, DC (United States), 25-29 May 1992). In *Beams 92: Proceedings: Volume 3, Microwaves, Free electron lasers, Advanced accelerators, Applications, and Plasma discharges.* 681p. Order Number DE94014785. Source: OSTI; NTIS; INIS.

CARMs are attractive sources for applications such as electron cyclotron resonance heating of fusion plasmas and driving high-gradient RF linear accelerators. For applications such as accelerator drivers, amplifiers or locked-oscillators are required. A 17 GHz cyclotron autoresonance maser (CARM) amplifier experiment is presently underway at the MIT Plasma Fusion Center. This experiment uses an electron beam generated by the 500 kV injector on the SRL/MIT SNO-MAD II induction accelerator. The present gun geometry produces a beam at 400 kV in a 50 ns pulse. The amplifier is designed to operate in the TE_{11} mode. To date, only second and third harmonic relativistic gyro-TWT modes have been seen. The power levels of these modes are $\sim$ 1 MW. The authors characterize these modes and discuss steps which they are taking in order to operate in the TE_{11} CARM mode. A high power, 17 GHz CARM amplifier has numerous applications. An RF injection electron gun is currently being designed at MIT that has RF input requirements quite comparable to the CARM amplifier's predicted rf output. A potential high degree of phase stability may allow the CARM amplifier to serve as a driver for future high gradient linear e^+e^- colliders.

28183 (DOE/ER/54160–1-Vol.3, pp. 1532-1537) **Cyclotron autoresonance maser (CARM) oscillator experiment at 28 GHz.** Gulotta, G. (Massachusetts Institute of Technology, Cambridge, MA (United States)); Alberta, S.; Danly, B.G.; Kimura, T.; Menninger, W.L.; Rullier, J.L.; Temkin, R.J. Maryland Univ., College Park, MD (United States). [1992]. DOE Contract FG02-89ER14052. (CONF-920515–Vol.3: 9. international conference on high power particle beams, Washington, DC (United States), 25-29 May 1992). In *Beams 92: Proceedings: Volume 3, Microwaves, Free electron lasers, Advanced accelerators, Applications, and Plasma discharges.* 681p. Order Number DE94014785. Source: OSTI; NTIS; INIS.

Experimental results on a long pulse, high frequency, cyclotron autoresonance maser oscillator (CARM) are reported. An electron gun produces a 1 μs, 450 kV, 80 A electron beam with good beam quality. A bifilar magnetic wiggler operated near the guide field resonance followed by an adiabatic compression of the guide field is used to impart transverse velocity ($\beta\perp$) to the beam. A capacitive probe, located after the adiabatic compression, is used to measure the mean parallel velocity of the beam, and using energy conservation the beam pitch ($\alpha = \beta\perp/\beta||$) is derived. The measured α values are significantly higher than the theoretical values. The interaction region is defined by a Bragg resonator designed to oscillate in the TE_{11} mode at 27.8 GHz (diffractive quality factor Q_D = 300). A cold test measurement of the resonant frequency of the Bragg resonator is consistent with the designed frequency. A rf power level of 1.9 MW (5.2% efficiency) has been measured in the TE_{11} mode at the designed frequency; however, significant mode competition is observed between TE_{11} mode and TM_{01} mode. Identification of these CARM modes is made by comparison of measured frequencies with cold test frequencies, uncoupled dispersion theory and measurement of the far field radiation pattern. Operation in the TE_{11} CARM mode occurred at a Doppler upshifted frequency of 2.9 times the relativistic cyclotron frequency.

28184 (DOE/ER/54160–1-Vol.3, pp. 1538-1544) **The electrodynamics of a co-axial plasma slow-wave structure of a plasma Cherenkov amplifier driven by a high-current reb in finite magnetic field.** Selivanov, I.A. (Institute for General Physics of the Russian Academy of Sciences, Moscow (Russian Federation)); Shkvarunets, A.G.; Tarakanov, V.P. Maryland Univ., College Park, MD (United States). [1992]. (CONF-920515–Vol.3: 9. international conference on high power particle beams, Washington, DC (United States), 25-29 May 1992). In *Beams 92: Proceedings: Volume 3, Microwaves, Free electron lasers, Advanced accelerators, Applications, and Plasma discharges.* 681p. Order Number DE94014785. Source: OSTI; NTIS; INIS.

The experiment devoted to microwave transport ($\omega_0 = 7.8*10^{10}$ s^{-1}, P = 100 W) down to co-axial plasma slow-wave structure in finite magnetic field (B = 0.02 - 2.5 T) is reported. The experimental results are treated in terms of the analytical and numerical ones obtained by using the following problem sets-up: (1)the general dispersion equation for the case of uniform plasma annulus with sharp boundaries; (2) the numerical solving of Maxwell equations for ϕ, z - components of electromagnetic field in the case of nonuniform radial plasma density profile; (3) the PIC - simulation for microwave transport down the co-axial plasma waveguide of finite length.

28185 (DOE/ER/54160–1-Vol.3, pp. 1545-1549) **Experimental study and PIC-simulation for the PCM operation.** Strelkov, P.S. (Institute for General Physics of the Russian Academy of Sciences, Moscow (Russian Federation)); Shkvarunets, A.G.; Tarakanov, V.P. Maryland Univ., College Park, MD (United States). [1992]. (CONF-920515–Vol.3: 9. international conference on high power particle beams, Washington, DC (United States), 25-29 May 1992). In *Beams 92: Proceedings: Volume 3, Microwaves, Free electron lasers, Advanced accelerators, Applications, and Plasma discharges.* 681p. Order Number DE94014785. Source: OSTI; NTIS; INIS.

The results of computer simulation for the PCM and the PCA operations are reported. The plasma annulus is considered to be cold, collisionless media (r_p = 0.9 cm, δ_p = 0.1 cm, L_p = 30 cm, R = 1.8 cm) with dielectric constant $\epsilon_p = (1 - \omega_p^2/\omega^2)$. The microwave power must be amplified by REB is generated by the M-band magnetron: λ = 2.71 cm, P = 150 kW. The hollow high-current REB (γ = 2.2) is PIC-simulated for the case of its injection into the plasma annulus. The electromagnetic fields are resulted from the numerical solving of Maxwell equations. This simulation showed that there exists the microwave generation at the wavelength λ - 3cm. Moreover, the generation wavelength decreases as the plasma density increases. The microwave power generated is of about tens megawatts for the REB current of 2 kA. The maximal efficiency is of about 5%. The excitation of the co-axial plasma waveguide by the external wave with microwave power of 100kW leads to the increase in the output microwave power within narrow region of plasma density. This takes place if the input frequency is coincident with the one of wave inherently generated. Also the authors present the experiment for the PCM operation and the preliminary experiment devoted to the PCA operation.

28186 (DOE/ER/54160–1-Vol.3, pp. 1550-1555) **Influence of cathode plasma upon the radiation pulse duration of vacuum microsecond relativistic microwave generator.** Loza, O.T. (Institute for General Physics, Moscow (Russian Federation)); Strelkov, P.S.; Voronkov, S.N. Maryland Univ., College Park, MD (United States). [1992]. (CONF-920515–Vol.3: 9. international conference on high power particle beams, Washington, DC (United States), 25-29 May 1992). In *Beams 92: Proceedings: Volume 3, Microwaves, Free electron lasers, Advanced accelerators, Applications, and Plasma discharges.* 681p. Order Number DE94014785. Source: OSTI; NTIS; INIS.

It was shown earlier, that microwave pulse duration in a relativistic microsecond generator is restricted in time by the electron beam radius enhancement. The method of fast magnetic decompression was proposed, that allows to stabilize the beam radius. This method was applied to the electron beam in a relativistic BWO and increased the microwave pulse duration.

28187 (DOE/ER/54160–1-Vol.3, pp. 1556-1561) **The "hose type" instability of REB and microwave generation in a waveguide.** Ruchadze, A.A. (General Physics Institute, Moscow (Russian Federation)); Rybak, P.V.; Tarakanov, V.P. Maryland Univ., College Park, MD (United States). [1992]. (CONF-920515–Vol.3: 9. international conference on high power particle beams, Washington, DC (United States), 25-29 May 1992). In *Beams 92: Proceedings: Volume 3, Microwaves, Free electron lasers, Advanced accelerators, Applications, and Plasma discharges.* 681p. Order Number DE94014785. Source: OSTI; NTIS; INIS.

The results of the computer simulation of the relativistic electron beam (REB) injection into vacuum waveguide through a conductive foil without the guide magnetic field are presented. The beam current is lower than that limiting current for this waveguide. The intense generation of TM_{2n}-mode with 15%-25% efficiency resulting from the formation of "hose type" instability is observed.

28188 (DOE/ER/54160–1-Vol.3, pp. 1562-1567) **On some practical consideration of the electron beam breakup transit time oscillator.** Kwan, T.J.T. (Los Alamos National Lab., NM (United States)). Maryland Univ., College Park, MD (United States). [1992]. (CONF-920515–Vol.3: 9. international conference on high power particle beams, Washington, DC (United States), 25-29 May 1992). In *Beams 92: Proceedings: Volume 3, Microwaves, Free electron lasers, Advanced accelerators, Applications, and Plasma discharges.* 681p. Order Number DE94014785. Source: OSTI; NTIS; INIS.

The electron beam breakup transit time oscillator (BTO) makes use of the interaction between an electron beam and the azimuthally asymmetric transverse magnetic mode (TM_{110}) of a cavity to facilitate the exchange of energy between them. Linear theory has shown a large growth rate in the regime where space-charge effects can be ignored. In this study, the authors have investigated the non-ideal elements in the BTO and evaluated their effects accordingly. The practical issues under consideration are electron beam quality, energy, and space-charge potential. Their calculations indicate only a modest unfavorable scaling with respect to these parameters.

28189 (DOE/ER/54160–1-Vol.3, pp. 1568-1573) **External quasi-optical feedback system for narrowing radiation band.** Bogachenkov, V.A. (P.N. Lebedev Physical Institute, Moscow (Russian Federation)); Papadichev, V.A.; Sinilshikova, I.V.; Smith, O.A. Maryland Univ., College Park, MD (United States). [1992]. (CONF-920515–Vol.3: 9. international conference on high power particle beams, Washington, DC (United States), 25-29 May 1992). In *Beams 92: Proceedings: Volume 3, Microwaves, Free electron lasers, Advanced accelerators, Applications, and Plasma discharges.* 681p. Order Number DE94014785. Source: OSTI; NTIS; INIS.

Previous work has demonstrated the generation of powerful microwave radiation in the 0.7-6 mm wavelength range in a smooth cylindrical waveguide. In order to investigate the possibility of easy retuning, mode selection and narrowing the radiation band an external quasi-optical feedback system has been proposed. The results of cold measurements for this system are presented.

28190 (DOE/ER/54160–1-Vol.3, pp. 1574-1579) **Relativistic magnetrons: Optimization of parameters and modelling of phase locking processes.** Alexandrovich, D.V. (Institute of Nuclear Physics, Tomsk (Russian Federation)); Baranov, S.V.; Didenko, A.N.; Filipenko, N.M.; Fomenko, G.P.; Pozdeev, V.V.; Sulakshin, A.S.; Maidanovskii, A.S.; Novikov, S.S. Maryland Univ., College Park, MD (United States). [1992]. (CONF-920515–Vol.3: 9. international conference on high power particle beams, Washington, DC (United States), 25-29 May 1992). In *Beams 92: Proceedings: Volume 3, Microwaves, Free electron lasers, Advanced accelerators, Applications, and Plasma discharges.* 681p. Order Number DE94014785. Source: OSTI; NTIS; INIS.

Calculations of microwave radiation power dependence upon magnetron parameters with a real voltage pulse shape being considered showed fairly good agreement with similar dependencies obtained experimentally. This allowed to choose magnetron optimal parameters in agreement with a high current accelerator as a power source. Next way to increase radiated power is to sum up powers of some pulse relativistic magnetrons. A scheme is based

on the principle of nonsymmetry allowing a rather strong mismatch of magnetrons eigenfrequencies and being not so critical to a choice of connection line length. The strong coupling provides fast phase locking and high efficiency of the pulse powers addition.

28191 (DOE/ER/54160–1-Vol.3, pp. 1580-1585) **The nonuniform-phase-velocity relativistic BWO.** Korovin, S.D. (Institute of High Current Electronics, Tomsk (Russian Federation)); Polevin, S.D.; Rostov, V.V.; Roitman, A.M. Maryland Univ., College Park, MD (United States). [1992]. (CONF-920515–Vol.3: 9. international conference on high power particle beams, Washington, DC (United States), 25-29 May 1992). In *Beams 92: Proceedings: Volume 3, Microwaves, Free electron lasers, Advanced accelerators, Applications, and Plasma discharges.* 681p. Order Number DE94014785. Source: OSTI; NTIS; INIS.

The possibility of increasing the efficiency of a carcinotron by varying the phase velocity of the -1th space harmonic in the class of single-step functions has been studied both numerically and experimentally. The numerical simulation has shown that increasing the phase velocity along the interaction space improves the phase relationships between the HF current and electromagnetic field and increases the efficiency of energy exchange to 70%. In the experiment carried out on the SINUS-K electron accelerator, a nonuniform-phase-velocity BWO operating with an efficiency of 45% and microwave pulse power of 500 MW has been realized.

28192 (DOE/ER/54160–1-Vol.3, pp. 1586-1591) **The state of art of investigations of relativistic multiwave microwave generators.** Bastrikov, A.N. (High Current Electronics Institute, Tomsk (Russian Federation)); Bugaev, S.P.; Chernyavsky, I.A.; Deichuli, M.P.; Khryapov, P.A.; Koshelev, V.I.; Lopatin, V.V.; Sochugov, N.S.; Sukhushin, K.N.; Zakharov, A.N. Maryland Univ., College Park, MD (United States). [1992]. (CONF-920515–Vol.3: 9. international conference on high power particle beams, Washington, DC (United States), 25-29 May 1992). In *Beams 92: Proceedings: Volume 3, Microwaves, Free electron lasers, Advanced accelerators, Applications, and Plasma discharges.* 681p. Order Number DE94014785. Source: OSTI; NTIS; INIS.

To carry out experimental investigations of multiwave microwave generators, new electron guns have been constructed and hollow electron beams with the power up to 100 GW and 15 GW have been obtained on the "Gamma" and "Sinus-7M" accelerators, respectively. A 3-cm wavelength range multiwave Cerenkov generator (MWCG) with a 11-cm-diameter nanosecond electron beam has been studied in detail. First results of investigations of MWCG with a 35-cm-diameter beam have been obtained.

28193 (DOE/ER/54160–1-Vol.3, pp. 1592-1595) **Cherenkov microwave generator of high-current relativistic electron beams.** Kovalev, N.F. (Institute of Applied Physics, Novgorod (Russian Federation)). Maryland Univ., College Park, MD (United States). [1992]. (CONF-920515–Vol.3: 9. international conference on high power particle beams, Washington, DC (United States), 25-29 May 1992). In *Beams 92: Proceedings: Volume 3, Microwaves, Free electron lasers, Advanced accelerators, Applications, and Plasma discharges.* 681p. Order Number DE94014785. Source: OSTI; NTIS; INIS.

Numerous experimental investigations have shown that relativistic electron beams produced at strong-current accelerators with cold burst-emission injectors can be used for generation of powerful pulses of coherent radiation in the microwave band. The maximum output power is achieved in the Cherenkov-type generators; this is primarily due to the possibility to use simple electron-optical systems in them, which can produce most powerful electron beams used for generation. It should be noted that it is very difficult to give a general and universal definition that would single out Cherenkov-type generators. For the sake of definiteness, to the generators of the Cherenkov type the author assigns here high-frequency sources whose operation is based on interaction of electromagnetic waves with waves of the spatial charge of the electron beam.

28194 (DOE/ER/54160–1-Vol.3, pp. 1596-1600) **Multiwave relativistic electron devices: Progress and prospects.** Cherepenin, V.A. (Institute of Radioengineering and Electronics, Moscow (Russian Federation)). Maryland Univ., College Park, MD (United States). [1992]. (CONF-920515–Vol.3: 9. international conference on high power particle beams, Washington, DC (United States), 25-29 May 1992). In *Beams 92: Proceedings: Volume 3, Microwaves, Free electron lasers, Advanced accelerators, Applications, and Plasma discharges.* 681p. Order Number DE94014785. Source: OSTI; NTIS; INIS.

During the last decade, attempts to use the properties of coherent eigen radiation of bunches of high-power relativistic electron streams have led to the multiwave conception of the beam-field interaction. In the multiwave electron devices an electron beam interacts simultaneously at a definite frequency with a number of modes, or waves, of electrodynamic structure within the syncronism band. The electron efficiency is shown to be higher in the multiwave regimes in comparison with the onewave ones. All types of multiwave devices are possible.

28195 (DOE/ER/54160–1-Vol.3, pp. 1601-1606) **High power X-band microwave amplifiers and their application for particle acceleration.** Davis, T.J. (Cornell Univ., Ithaca, NY (United States)); Ivers, J.D.; Kerslick, G.S.; Kuang, E.; Nation, J.A.; Oppenheim, M.; Schaechter, L. Maryland Univ., College Park, MD (United States). [1992]. (CONF-920515–Vol.3: 9. international conference on high power particle beams, Washington, DC (United States), 25-29 May 1992). In *Beams 92: Proceedings: Volume 3, Microwaves, Free electron lasers, Advanced accelerators, Applications, and Plasma discharges.* 681p. Order Number DE94014785. Source: OSTI; NTIS; INIS.

The authors report results from experiments studying X-Band amplification in both cylindrical traveling wave tube (TWT) and coaxial drift tube geometries. In the TWT geometry 800-900 kV, 1-2 kA, 50-100 ns electron beams are injected into cylindrical guides containing slow wave structures. The amplifiers operate in the TM_{01} mode. With single stage ripple wall slow wave structures gains of order 30 dB have been obtained with output powers of 100 MW. Using a dielectric loaded TWT amplifier gains of 30 dB have also been measured, although at lower output powers of 35 MW. In the coaxial geometry a 9 cm diameter annular, 400 kV, 7 kA, 50 ns electron beam is injected through a 16 cm dielectrically loaded cavity, and an X-Band magnetron provides frequency locking of the interaction. The interaction processes involved in these devices have been studied analytically and also simulated with the MAGIC code. These studies show significant electron energy spreads result from the amplification process in the TWT devices. A magnetic spectrometer has been built to analyze the output energy spectrum of the accelerated electrons. Preliminary results from this experiment show evidence of a change in the electron distribution at the amplifier output when the r.f. power is present.

28196 (DOE/ER/54160–1-Vol.3, pp. 1607-1612) **Recent results from the University of Maryland overmoded BWO and MWCG Program.** Abe, D.K. (Univ. of Maryland, College Park, MD (United States)); Antonsen, T. Jr.; Carmel, Y.; Levush, B.; Miller, S.M.; Bromborsky, A. Maryland Univ., College Park, MD (United States). [1992]. (CONF-920515–Vol.3: 9. international conference on high power particle beams, Washington, DC (United States), 25-29 May 1992). In *Beams 92: Proceedings: Volume 3, Microwaves, Free electron lasers, Advanced accelerators, Applications, and Plasma discharges.* 681p. Order Number DE94014785. Source: OSTI; NTIS; INIS.

Two classes of overmoded high power microwave (HPM) devices are under experimental investigation by the University of Maryland: overmoded backward wave oscillators (BWOs) and multiwave Cerenkov generators (MWCGs). Both structures use an overmoded, cylindrically symmetric, periodically corrugated slow wave structure (SWS), immersed in a strong axial magnetic field. In the case of the MWCG, two sections of corrugated waveguide are separated by a smooth walled drift section which is not cutoff to the RF radiation. The authors interest in the MWCG is the result of pioneering work done at the Institute of High Current Electronics in Tomsk, which produced a record 7.5 GW of microwave power in air at a wavelength of $\approx$ 3 cm. The University of Maryland experiments operate at a lower power and frequency, with the goal of improving the physical understanding of the overmoded BWO and MWCG.

28197 (DOE/ER/54160–1-Vol.3, pp. 1613-1618) **Theory of relativistic backward wave oscillators operating near cutoff.**

Miller, S.M. (Univ. of Maryland, College Park, MD (United States)); Antonsen, T.M. Jr.; Levush, B.; Bromborsky, A. Maryland Univ., College Park, MD (United States). [1992]. (CONF-920515–Vol.3: 9. international conference on high power particle beams, Washington, DC (United States), 25-29 May 1992). In *Beams 92: Proceedings: Volume 3, Microwaves, Free electron lasers, Advanced accelerators, Applications, and Plasma discharges.* 681p. Order Number DE94014785. Source: OSTI; NTIS; INIS.

Backward-Wave Oscillators utilize a high-current electron beam to produce high power, coherent radiation in the centimeter and millimeter wavelength regime. Under certain voltage and beam current operating conditions, a Backward-Wave Oscillator (BWO) can operate near the upper edge of the transmission band where the group velocity of the electromagnetic wave goes to zero. In this regime, the cold structure dispersion relation can be approximated as a quadratic function of the wavenumber. A theoretical model has been developed to describe the operation of the device in this regime. The authors solve a self-consistent set of equations to describe the slow evolution of the envelope of the radiation field and the relativistic motion of the particles along a strong magnetic field. Included in the theoretical model are the effects of D.C. and A.C. space charge, and velocity spread in the beam. Numerical calculations of the starting current are performed and compared with an analytic expression for the starting current derived by assuming a fixed field profile.

28198 (DOE/ER/54160–1-Vol.3, pp. 1619-1624) **Theory of relativistic backward wave oscillators operating near cyclotron resonance.** Vlasov, A. (Univ. of Maryland, College Park, MD (United States)); Nusinovich, G.; Levush, B.; Bromborsky, A. Maryland Univ., College Park, MD (United States). [1992]. (CONF-920515–Vol.3: 9. international conference on high power particle beams, Washington, DC (United States), 25-29 May 1992). In *Beams 92: Proceedings: Volume 3, Microwaves, Free electron lasers, Advanced accelerators, Applications, and Plasma discharges.* 681p. Order Number DE94014785. Source: OSTI; NTIS; INIS.

A linear and nonlinear, time dependent self-consistent theory for a relativistic backward wave oscillator is developed. In this theory the transverse motion of the electrons is taken into account. Analytical and numerical analysis of the model equations near the cyclotron resonance gives a good estimate for the power drop due to the cyclotron absorption observed in many experiments and predicts an increase in the power under some conditions.

28199 (DOE/ER/54160–1-Vol.3, pp. 1625-1630) **Dielectric Cherenkov maser as a powerful amplifier with superwide bandwidth.** Shlapakovskii, A.S. (Institute of Nuclear Physics, Tomsk (Russian Federation)); Chirko, K.A. Maryland Univ., College Park, MD (United States). [1992]. (CONF-920515–Vol.3: 9. international conference on high power particle beams, Washington, DC (United States), 25-29 May 1992). In *Beams 92: Proceedings: Volume 3, Microwaves, Free electron lasers, Advanced accelerators, Applications, and Plasma discharges.* 681p. Order Number DE94014785. Source: OSTI; NTIS; INIS.

An important feature of dielectric Cherenkov masers (DCM), distinguishing them from other FEL kinds is emphasized. So far practically all DCM experiments were carried out with rather thin dielectric liners or films. Meanwhile, when the coefficient of waveguide filling by the dielectric is not small, the beam wave coupling doesn't depend on frequency, and, hence, superwide bandwidth is possible. The value of bandwidth is significantly determined also by the current and velocity of electron beam. In this context DCM dispersion relations have been analysed: Analytically in simplest of total waveguide filling and numerically, for a hollow beam in a waveguide with dielectric liner. It has been shown that maximum value of bandwidth is achieved at a certain optimal value of the beam current for fixed velocity (and vice versa). Numerical results demonstrate the -3 dB bandwidth of 40-50% at a peak gain of 40 dB for usual electron energies (300-600 keV) and beam currents (1-10 kA). Also, an effect of discontinuous gain disappearance at a lower boundary of the band has been found.

28200 (DOE/ER/54160–1-Vol.3, pp. 1631-1636) **Experimental study of a plasma-filled backward wave oscillator.** Zhai, X. (Univ. of California, Irvine, CA (United States)); Garate, E.; Prohaska, R.; Fisher, A.; Benford, G. Maryland Univ., College Park, MD (United States). [1992]. Contract 90-0255. (CONF-920515–Vol.3: 9. international conference on high power particle beams, Washington, DC (United States), 25-29 May 1992). In *Beams 92: Proceedings: Volume 3, Microwaves, Free electron lasers, Advanced accelerators, Applications, and Plasma discharges.* 681p. Order Number DE94014785. Source: OSTI; NTIS; INIS.

The authors present experimental studies of a plasma-filled X-band backward wave oscillator (BWO). Depending on the background gas pressure, microwave frequency upshifts of up to 1 GHz appeared along with an enhancement by a factor of 7 in the total microwave power emission. The bandwidth of the microwave emission increased from $\lesssim$0.5 GHz to 2 GHz when the BWO was working at the RF power enhancement pressure region. The RF power enhancement appeared over a much wider pressure range in a high beam current case (10-100 mT for 3 kA) as compared to a lower beam case (80-115 mT for 1.6 kA). The plasma-filled BWO has higher power output compared to the vacuum BWO over a broader region of magnetic guide field strength. Trivelpiece-Gould modes (T-G modes) are observed with frequencies up to the background plasma frequency in a plasma-filled BWO. Mode competition between the Trivelpiece-Gould modes and the X-band TM_{01} mode prevailed when the background plasma density was below 6×10^{11} cm^{-3}. At a critical background plasma density of $n_{cr} \simeq 8 \times 10^{11}$ cm^{-3} power enhancement appeared in both X-band and the T-G modes, with mode collaboration. Power enhancement of the S-band in this mode collaboration region reached up to 8 dB. Electric fields measured by Stark-effect method were as high as 34 kV/cm while BWO power level was 80 MW. These electric fields lasted throughout the high power microwave pulse.

28201 (DOE/ER/54160–1-Vol.3, pp. 1637-1642) **PASOTRON™ high-energy microwave source.** Butler, J.M. (Hughes Research Labs., Malibu, CA (United States)); Goebel, D.M.; Schumacher, R.W.; Hyman, J.; Santoru, J.; Watkins, R.M.; Harvey, R.J.; Dolezal, F.A.; Eisenhart, R.L.; Schneider, A.J. Maryland Univ., College Park, MD (United States). [1992]. (CONF-920515–Vol.3: 9. international conference on high power particle beams, Washington, DC (United States), 25-29 May 1992). In *Beams 92: Proceedings: Volume 3, Microwaves, Free electron lasers, Advanced accelerators, Applications, and Plasma discharges.* 681p. Order Number DE94014785. Source: OSTI; NTIS; INIS.

A unique, high-energy microwave source, called PASOTRON for Plasma-Assisted Slow-wave Oscillator has been developed. Similar to the Backward Wave Oscillator (BWO), the PASOTRON spontaneously generates microwave radiation by efficiently converting electron beam energy into electromagnetic radiation. The PASOTRON, however, utilizes a novel E-gun and plasma-filled slow-wave structure (SWS) to produce and propagate very long, high-power beam pulses which require no axial magnetic fields for transport. The long electron beam pulses are obtained from a Hughes Hollow-Cathode Plasma (HCP) E-gun, which employs a low-pressure glow discharge to provide a stable, high current-density electron source. Electrons from this source are accelerated through a multi-aperture array to produce a large area, high-current beam consisting initially of many individual beamlets. Since the device is operated in the ion focused regime, the plasma filling the SWS, space-charge neutralizes the beam, and the Bennett self-pinch compresses the beamlets and increases the beam's current density. Experimental results from a PASOTRON tube designed to operate in a TM_{01} mode at C-band frequencies when driven by a 50-to-100-kV, 50-to-250 A electron beam are reported. Results show output power is in the 1-to-4 MW range, for rf pulselengths up to 100 μsec, corresponding to an integrated energy per pulse of up to 300 J. Calculations show the E-beam to microwave-radiation power-conversion efficiency is ~20%. Instantaneous bandwidth measurements further reveal that for the duration of the long rf pulse the PASOTRON's oscillation center frequency maintains a narrow line < 3 MHz.

28202 (DOE/ER/54160–1-Vol.3, pp. 1643-1648) **Theory of the interaction of electron beams with the waves in plasma**

filled waveguides. Karbushev, N.I. (Moscow Radiotechnical Institute (Russian Federation)); Kolosov, Yu.A.; Ostrenskiy, Ye.I.; Polovkov, A.I.; Shatkus, A.D.; Mitin, L.A.; Volokitenkova, I.L.; Balakirev, V.A.; Sotnikov, G.V. Maryland Univ., College Park, MD (United States). [1992]. (CONF-920515–Vol.3: 9. international conference on high power particle beams, Washington, DC (United States), 25-29 May 1992). In *Beams 92: Proceedings: Volume 3, Microwaves, Free electron lasers, Advanced accelerators, Applications, and Plasma discharges.* 681p. Order Number DE94014785. Source: OSTI; NTIS; INIS.

The interaction of electron beams with electromagnetic waves in plasma filled waveguides is investigated theoretically. It is shown that plasma can considerably improve the characteristics of vacuum microwave devices and allow to reach the higher amplification, efficiency and output power.

28203 (DOE/ER/54160–1-Vol.3, pp. 1649-1654) **Research on a 1.3 GHz annular electron beam powered multi-gigawatt microwave amplifier.** Hendricks, K.J. (Phillips Lab., Kirtland, NM (United States)); Fayne, W.R.; Bowers, L.A.; Davis, C.E.; Haworth, M.D.; Platt, R.C.; Lemke, R.W.; Clark, M.C. Maryland Univ., College Park, MD (United States). [1992]. (CONF-920515–Vol.3: 9. international conference on high power particle beams, Washington, DC (United States), 25-29 May 1992). In *Beams 92: Proceedings: Volume 3, Microwaves, Free electron lasers, Advanced accelerators, Applications, and Plasma discharges.* 681p. Order Number DE94014785. Source: OSTI; NTIS; INIS.

The authors have been conducting experiments and computer simulations of annular electron beam powered microwave devices. This work includes the generation of an annular electron beam using the IMP pulser (500 kV, 5 Ω, 300 ns), the modulation of this beam by the Single Cavity Double Gap Modulator and a two cavity klystron-like amplifier, and the extraction or radiation of the microwave power via a Vlasov antenna. They have conducted experiments with two different geometries, one with the annular beam inside the microwave circuit and one with the microwave circuit inside the annular beam. They present results of computer simulations from the 2-D code MAGIC and experiments for both geometries. They also present results of simulations and experiments on injecting a magnetron signal into the two cavity klystron-like amplifier via RG-220 50 Ω cable. The MAGIC simulations of the amplifier are compared with the code Superfish to verify that the antenna model of MAGIC establishes the proper mode in the cavity.

28204 (DOE/ER/54160–1-Vol.3, pp. 1655-1660) **Application of high-current accelerators with inductors, based on distributed parameters lines for generation of high-power microwave pulses.** Pavlovskii, A.I. (Experimental Physics Research Institute, Novgorod (Russian Federation)); Selemir, V.D.; Ivanov, V.V.; Konovalov, I.V.; Prikhod'ko, I.G.; Suvorov, U.G.; Shibalko, K.V.; Kornilov, V.G.; Vatrunin, U.Y.; Zhdanov, V.S. Maryland Univ., College Park, MD (United States). [1992]. (CONF-920515–Vol.3: 9. international conference on high power particle beams, Washington, DC (United States), 25-29 May 1992). In *Beams 92: Proceedings: Volume 3, Microwaves, Free electron lasers, Advanced accelerators, Applications, and Plasma discharges.* 681p. Order Number DE94014785. Source: OSTI; NTIS; INIS.

Considerable increase of accelerating voltage in comparison with the charging one along with high quality of electron beam to be formed, is obtained using in microwave generators accelerating module from inductors, based on lines with distributed parameters. Electron beam, formed in a magnetic field in the range from 4 kG to 20 kG (pulse duration 20 ns, current 15 kA and electron energy 3 MeV) interacted with rippled (ripple period of 16 mm) waveguide, generates high power microwave pulse in the frequency range of 10 GHz with an amplitude of several gigawatt. Application of high-current accelerators, with inductors, based on distributed parameters lines, in Cherenkov generators, allows to increase microwave power and advance them into more short wave region.

28205 (DOE/ER/54160–1-Vol.3, pp. 1661-1666) **Effect of Intense space charge in Relativistic Klystron Amplifiers.** Carlsten, B.E. (Los Alamos National Lab., NM (United States)); Faehl, R.J.; Fazio, M.V.; Kwan, T.J.; Rickel, D.G.; Ryne, R.D.; Stringfield, R.M. Maryland Univ., College Park, MD (United States). [1992]. (CONF-920515–Vol.3: 9. international conference on high power particle beams, Washington, DC (United States), 25-29 May 1992). In *Beams 92: Proceedings: Volume 3, Microwaves, Free electron lasers, Advanced accelerators, Applications, and Plasma discharges.* 681p. Order Number DE94014785. Source: OSTI; NTIS; INIS.

The authors discuss basic Relativistic Klystron Amplifier (RKA) physics. They show that, for pulse lengths of one microsecond or longer in the intense space-charge regime, the maximum power extraction from the beam does not coincide with the maximum harmonic bunching. They also discuss the beam-cavity interaction model and present experimental and theoretical single cavity modulation results. Finally, they discuss alternatives to the basic RKA design that enhance beam to microwave power conversion efficiency, particularly at high frequency.

28206 (DOE/ER/54160–1-Vol.3, pp. 1667-1672) **A proposed extended cavity for coaxial relativistic klystrons.** Schaechter, L. (Cornell Univ., Ithaca, NY (United States)); Davis, T.J.; Nation, J.A. Maryland Univ., College Park, MD (United States). [1992]. (CONF-920515–Vol.3: 9. international conference on high power particle beams, Washington, DC (United States), 25-29 May 1992). In *Beams 92: Proceedings: Volume 3, Microwaves, Free electron lasers, Advanced accelerators, Applications, and Plasma discharges.* 681p. Order Number DE94014785. Source: OSTI; NTIS; INIS.

The quality factor of a coaxial klystron cavity is relatively low due to the coupling to the TEM mode which can propagate in the annular channel. This leads to low efficiency, especially at high frequency, e.g., X-band. To mitigate this effect the authors replace the usual cavity with an extended length, active cavity. The cavity consists of either a coaxial structure partially loaded with dielectric material or with a periodic structure. The interaction of the electrons is with the TM_{01} mode within the cavity, which extends over several wavelengths. Outside the loaded section only the TEM mode can exist. At the boundaries the TM_{01} mode and the TEM mode are coupled, therefore part of the power gained by the former mode is transferred to the TEM mode in the channel. One of the advantages of this system is the fact that the interaction length is larger than the wavelength, the local electric field intensity lower and therefore the breakdown probability is reduced. A theoretical analysis of the device is discussed including analytical and simulation work. Typical results for a 7 kA, 400 kV beam show an equivalent gain of 1 dB/cm can be expected at 9 GHz.

28207 (DOE/ER/54160–1-Vol.3, pp. 1673-1678) **Relativistic high power klystrons.** Sandalov, A.N. (Moscow State Univ. (Russian Federation)); Pikunov, V.M.; Rodiakin, V.E.; Stogov, A.A. Maryland Univ., College Park, MD (United States). [1992]. (CONF-920515–Vol.3: 9. international conference on high power particle beams, Washington, DC (United States), 25-29 May 1992). In *Beams 92: Proceedings: Volume 3, Microwaves, Free electron lasers, Advanced accelerators, Applications, and Plasma discharges.* 681p. Order Number DE94014785. Source: OSTI; NTIS; INIS.

The design and the first testing of relativistic klystrons amplifier (RKA) with the efficiency of 40-50% for realization on intense electron beams with beam energy 400 keV are presented. Theoretical investigations of RKA have been made by 1D, 1.5D, and 2.5D PIC codes. The self-field structure of relativistic electron bunch is numerically studied from these codes.

28208 (DOE/ER/54160–1-Vol.3, pp. 1679-1684) **A nonlinear theory of energy and current modulation in relativistic klystron amplifiers.** Uhm, H.S. (Naval Surface Warfare Center, Silver Spring, MD (United States)). Maryland Univ., College Park, MD (United States). [1992]. (CONF-920515–Vol.3: 9. international conference on high power particle beams, Washington, DC (United States), 25-29 May 1992). In *Beams 92: Proceedings: Volume 3, Microwaves, Free electron lasers, Advanced accelerators, Applications, and Plasma discharges.* 681p. Order Number DE94014785. Source: OSTI; NTIS; INIS.

A self-consistent nonlinear theory of the energy and current modulation in a relativistic electron beam propagating through a klystron amplifier is developed. A closed integro-differential equation for the beam current is obtained, assuming that the beam

current is a function of time t and propagation distance z. Properties of the current and energy modulation are investigated from this integro-differential equation for a broad range of system parameters. Magnitudes of the energy and current modulation are determined in terms of the gap voltage, the cavity frequency, geometric configuration, the beam intensity and initial kinetic energy of the beam. The modulation amplitude increases, reaches peak and decreases slowly, as the beam propagates through the amplifier.

28209 (DOE/ER/54160–1-Vol.3, pp. 1685-1689) **The time energy compression of pulse microwave vircator radiation.** Chumerin, P.Yu. (Institute of Nuclear Physics, Tomsk (Russian Federation)); Melnikov, G.V.; Novikov, S.A.; Razin, S.V.; Yushkov, Yu.G.; Zcherlitsin, A.G.; Didenko, A.N. Maryland Univ., College Park, MD (United States). [1992]. (CONF-920515–Vol.3: 9. international conference on high power particle beams, Washington, DC (United States), 25-29 May 1992). In *Beams 92: Proceedings: Volume 3, Microwaves, Free electron lasers, Advanced accelerators, Applications, and Plasma discharges.* 681p. Order Number DE94014785. Source: OSTI; NTIS; INIS.

The microwave pulse energy compression method supplies power amplification factor of about numbers of tens. It is probable to yield microwave pulses of 10^8 - 10^9 W power and 1 ns width in L and S-bands by utilizing relativistic generators as existing sources. This report covers the first experimental data of the time energy compression of the output pulse radiation of the relativistic virtual cathode triode and cyclotron resonance vircator.

28210 (DOE/ER/54160–1-Vol.3, pp. 1690-1695) **Frequency control of vircators microwave radiation.** Didenko, A.N. (Moscow Engineering and Physical Institute (Russian Federation)); Antoshkon, M.Yu.; Fomenko, G.P.; Grigoryev, V.P.; Koval, T.V.; Melnikov, G.V.; Tsvetkov, V.I.; Zherlitsin, A.G. Maryland Univ., College Park, MD (United States). [1992]. (CONF-920515–Vol.3: 9. international conference on high power particle beams, Washington, DC (United States), 25-29 May 1992). In *Beams 92: Proceedings: Volume 3, Microwaves, Free electron lasers, Advanced accelerators, Applications, and Plasma discharges.* 681p. Order Number DE94014785. Source: OSTI; NTIS; INIS.

Possibility of frequency control in vircators by means of beam parameters, magnetic field and external microwave signal has been studied. The conditions have been found when generated frequency doesn't depend on magnetic field B but radiation power has resonant dependence on B. It has been shown that some vircators can operate at two frequencies simultaneously.

28211 (DOE/ER/54160–1-Vol.3, pp. 1696-1699) **Numerical simulation and experiment study of vircator.** Zhixiong, Wang; Yanqiao, Chen; Yusheng, Chen; Ruyu, Fan. Maryland Univ., College Park, MD (United States). [1992]. (CONF-920515–Vol.3: 9. international conference on high power particle beams, Washington, DC (United States), 25-29 May 1992). In *Beams 92: Proceedings: Volume 3, Microwaves, Free electron lasers, Advanced accelerators, Applications, and Plasma discharges.* 681p. Order Number DE94014785. Source: OSTI; NTIS; INIS.

A 2 1/2 dimensional, fully electromagnetic, relativistic CIC particle simulation code has been developed to simulate the virtual cathode oscillations and the HPM generations. Solid electron beams are used both in the simulations and the experiments. The microwave radiations whose average power is of the order of GW have been observed. The simulations are in agreement with the experiments.

28212 (DOE/ER/54160–1-Vol.3, pp. 1700-1705) **Experimental study of virtual cathode oscillator in uniform magnetic field.** Kostov, K.G. (Sofia Univ. (Bulgaria)); Nikolov, N.A.; Spasovsky, I.P.; Atanassov, R. Maryland Univ., College Park, MD (United States). [1992]. (CONF-920515–Vol.3: 9. international conference on high power particle beams, Washington, DC (United States), 25-29 May 1992). In *Beams 92: Proceedings: Volume 3, Microwaves, Free electron lasers, Advanced accelerators, Applications, and Plasma discharges.* 681p. Order Number DE94014785. Source: OSTI; NTIS; INIS.

High-frequency high-power microwave radiations by a virtual cathode oscillator have been obtained. The authors performed experiments using 350 kV, 7 kA, 30 ns electron beam. A virtual cathode forms when the magnetized relativistic electron beam is injected into circular waveguide. The microwave generation exists in wide range of magnetic field magnitudes (2 kGs-40 kGs). The measured peak microwave power is about 15 MW at frequency region of 11-17 GHz. The radiation frequency has not depend on the magnetic field intensity. A nonsymmetric TM mode is observed. The sources of the microwave emission are both the reflexing electrons and the oscillating virtual cathode.

28213 (DOE/ER/54160–1-Vol.3, pp. 1837-1842) **Modeling high-power RF accelerator cavities with SPICE.** Humphries, S. Jr. (Univ. of New Mexico, Albuquerque, NM (United States)). Maryland Univ., College Park, MD (United States). [1992]. (CONF-920515–Vol.3: 9. international conference on high power particle beams, Washington, DC (United States), 25-29 May 1992). In *Beams 92: Proceedings: Volume 3, Microwaves, Free electron lasers, Advanced accelerators, Applications, and Plasma discharges.* 681p. Order Number DE94014785. Source: OSTI; NTIS; INIS.

The dynamical interactions between RF accelerator cavities and high-power beams can be treated on personal computers using a lumped circuit element model and the SPICE circuit analysis code. Applications include studies of wake potentials, two-beam accelerators, microwave sources, and transverse mode damping. This report describes the construction of analogs for TM_{mn0} modes and the creation of SPICE input for cylindrical cavities. The models were used to study continuous generation of kA electron beam pulses from a vacuum cavity driven by a high-power RF source.

28214 (DOE/ER/54160–1-Vol.3, pp. 1924-1929) **REB pumped systems with multipole magnetic field wall shielding.** Mkheidze, G.P. (General Physics Institute, Vavilov (Russian Federation)); Savin, A.A.; Trintchouk, F.B. Maryland Univ., College Park, MD (United States). [1992]. (CONF-920515–Vol.3: 9. international conference on high power particle beams, Washington, DC (United States), 25-29 May 1992). In *Beams 92: Proceedings: Volume 3, Microwaves, Free electron lasers, Advanced accelerators, Applications, and Plasma discharges.* 681p. Order Number DE94014785. Source: OSTI; NTIS; INIS.

Effective systems of REB injection have been proposed. Injection through multipole magnetic field allows to control spatial distribution of deposited energy and to reach high deposition efficiency (up to 90%).

28215 (FNAL/C–94/182) **A long pulse modulator for reduced size and cost.** Pfeffer, H.; Bartelson, L.; Bourkland, K.; Jensen, C.; Kerns, Q.; Prieto, P.; Saewert, G.; Wolff, D. Fermi National Accelerator Lab., Batavia, IL (United States). Jul 1994. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH03000. (CONF-940678–6: 21. international power modulator symposium, Costa Mesa, CA (United States), 28-30 Jun 1994). Order Number DE94015542. Source: OSTI; NTIS; INIS; GPO Dep.

A novel modulator has been designed, built and tested for the TESLA test facility. This e^+ e^- accelerator concept uses superconducting RF cavities and requires 2ms of RF power at 10 pps. As the final accelerator will require several hundred modulators, a cost effective, space saving and high efficiency design is desired. This modulator used a modest size switched capacitor bank that droops approximately 20% during the pulse. This large droop is compensated for by the use of a resonant LC circuit. The capacitor bank is connected to the high side of a pulse transformer primary using a series GTO switch. The resonant circuit is connected to the low side of the pulse transformer primary. The output pulse is flat to within 1% for 1.9 ms during a 2.3 ms base pulse width. Measured efficiency, from breaker to klystron and including energy lost in the rise time, is approximately 85%.

28216 (FNAL-TM–1893) **A preliminary power consumption estimate for a toroid spoiler magnet proposed for the PWest upgrade.** Kristalinski, A.L. Fermi National Accelerator Lab., Batavia, IL (United States). 28 Jun 1994. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH03000. Order Number DE94015725. Source: OSTI; NTIS; INIS; GPO Dep.

The estimate is based on the preliminary magnet design provided by B. Lundberg. The required magnetic field induction in the

winding carrying toroid leg is specified as an initial condition. Based on the cross section areas of the toroid legs the induction in all four toroid legs can be calculated. The particular type of steel which will be used is unknown so they used the curve on Fig. 2 for the most wide spread steels to obtain a field strength in the steel. The number of steel plates and accordingly the resulting technological air gap are unknown, therefore the calculation for two different gaps .25 mm and 2.5 mm were preformed. Results of the power consumption calculations for the proposed toroid spoiler magnet for different magnetic field induction values and two different air gaps are given. Operating costs for running the magnet are also given.

28217 (GSI–93-36(prepr.)) **Developments of ^{207}Pb, ^{208}Pb and ^{209}Bi target wheels in the synthesis of $_{107}$Ns, $_{108}$Hs and $_{109}$Mt.** Folger, H.; Hartmann, W.; Hessberger, F.P.; Hofmann, S.; Klemm, J.; Muenzenberg, G.; Ninov, V.; Schmidt, K.H.; Schoett, H.J.; Thalheimer, W.; Armbruster, P. Gesellschaft fuer Schwerionenforschung mbH, Darmstadt (Germany). May 1993. 15p. (CONF-920933–: 16. world conference of the International Nuclear Target Development Society: nuclear target preparation, Legnaro (Italy), 21-25 Sep 1992). Order Number DE94787008. Source: OSTI; NTIS (US Sales Only); INIS.

The developments of ^{207}Pb, ^{208}Pb and ^{209}Bi target wheels and their applications in heavy-ion fusion reactions are reviewed. In both, fabrication and use, the centers of the evaporator or accelerator beams are focussed at wheel radii of 155 mm to specially shaped frames which generate very homogeneous target layers and very constant reaction and counting rates in the experiment. Target areas of up to ≈98% of a wheel's circumference of 974 mm can be provided. The preparation procedures for necessary C backings and protecting layers of C are described, and details are given for the developments of high-vacuum evaporations of ^{207}Pb, ^{208}Pb and ^{209}Bi with deposition yields of 35-55% from tantalum crucibles. The applications of the target wheels in heavy-ion fusion reactions with beams of ^{54}Cr and ^{58}Fe at energies near the Coulomb barrier and intensities of ≈10^{12} particles/s are mentioned. The target parameters for the production runs of the new chemical elements $_{107}$Ns, $_{108}$Hs and $_{109}$Mt are included. (orig.)

28218 (GSI–94-24(prepr.)) **BRENDA, the GSI RIB-facility.** Armbruster, P. Gesellschaft fuer Schwerionenforschung mbH, Darmstadt (Germany). Apr 1994. 14p. (CONF-940192–: 32. international meeting on nuclear physics, Bormio (Italy), 24-29 Jan 1994). Order Number DE94789759. Source: OSTI; NTIS (US Sales Only); INIS.

In 1985 the decision was taken to build the Heavy-Ion Synchrotron (SIS) together with an Experimental Storage Ring (ESR) and a number of experimental facilities. The energy range covered by SIS is the same as the former BEVALAC. Higher beam intensities, better beam quality of SIS, the ESR, and the dedicated experiments allowed to plan an experimental programme going beyond what was done at LBL. The SIS filled to its space charge limit, and fast ramping times (1 s) promised high beam intensities. The field of exotic nuclei and secondary beams has been from the beginning an integral part of the planned new facility. A new high current injector modifying the UNILAC serving now as SIS-injector, a high dose target station at the end of SIS, and a fragment separator (FRS) for relativistic projectile fragments supplying all facilities with secondary beams were endorsed by the Machine- and Programme-Advisory Committees of the SIS-Project. Since 1991 Beams of Relativistic Exotic Nuclei from Darmstadt (BRENDA) are available with moderate intensities. Higher intensities wait for the projected, but not yet built high current injector. I show that interesting experiments were done nevertheless and why we were quite successful even with low intensity secondary beams. (orig.)

28219 (KEK-PROC–93-7, pp. 76-80) **Lattice with a small momentum compaction for the KEK B-factory.** Koiso, Haruyo (National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan)). National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan). Jun 1993. (CONF-9211172–: International workshop on B factories: accelerators and experiments, Tsukuba (Japan), 17-20 Nov 1992). In *Proceedings of international workshop on B-factories: accelerators and experiments (BFWS92).* 435p. Order Number DE94737962. Source: OSTI; NTIS; INIS.

A lattice with a small momentum compaction and a small synchrotron tune is designed for the KEK B-Factory. This lattice enables us to decrease the RF voltage drastically and to suppress beam instabilities caused by RF cavities. The dynamic aperture of this lattice is widened to satisfy the requirements for injection by using a chromaticity correction scheme with noninterleaved sextupoles. The small synchrotron tune is also helpful to avoid the synchro-betatron resonances which reduce the momentum acceptance in the noninterleaved scheme. Even with machine errors, the dynamic aperture remains acceptable. (author).

28220 (KEK-PROC–93-7, pp. 81-83) **Proposal of the round beam lattice for VEPP-2M collider.** Filippov, A.N. (AN SSSR, Novosibirsk (Russian Federation). Inst. Yadernoj Fiziki); Ivanov, P.M.; Koop, I.A.; Perevedentsev, E.A.; Shatunov, Yu.M.; Skrinsky, A.N. National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan). Jun 1993. (CONF-9211172–: International workshop on B factories: accelerators and experiments, Tsukuba (Japan), 17-20 Nov 1992). In *Proceedings of international workshop on B-factories: accelerators and experiments (BFWS92).* 435p. Order Number DE94737962. Source: OSTI; NTIS; INIS.

The round colliding beam performance is proposed on VEPP - 2M collider to verify the advantage of the round beams envisaged in the Novosibirsk ϕ-factory project, where the high design values of the space charge parameter are of critical importance. Minor modifications of the existing machine lattice include installation of four 10T SC solenoids to provide for the axisymmetric final focus and for the equal transverse emittances, and rearrangement of the arc optics to form two achromatic bends between the interaction points, etc. The design luminosity above 10^{32} cm^{-2}s^{-1} will be available for the two new detectors CMD-2 and SND now operated at VEPP-2M. (author).

28221 (KEK-PROC–93-7, pp. 118-122) **Damped RF cavity in KEK.** Suetake, M. (National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan)); Akai, K.; Higo, T.; Takata, K.; Yamazaki, Y.; Yoshimoto, S. National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan). Jun 1993. (CONF-9211172–: International workshop on B factories: accelerators and experiments, Tsukuba (Japan), 17-20 Nov 1992). In *Proceedings of international workshop on B-factories: accelerators and experiments (BFWS92).* 435p. Order Number DE94737962. Source: OSTI; NTIS; INIS.

A prototype damped cavity has been constructed for the KEK B-factory. We have tested the performance of the cavity. The cavity was found to be used for a 420-bunch scheme (Phase I). In this paper we first show the requirements of the Q values for the higher-order modes; and we then describe the way of the optimization of a damped cavity using a 3D code called MAFIA to try to produce Q values on the order of 30. Lastly, we show the profile of a prototype damped cavity and the results of the low power test. (author).

28222 (KEK-PROC–93-7, pp. 123-132) **RF cavity development for the PEP-II B factory.** Rimmer, R.A. (Lawrence Berkeley Lab., CA (United States)). National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan). Jun 1993. (CONF-9211172–: International workshop on B factories: accelerators and experiments, Tsukuba (Japan), 17-20 Nov 1992). In *Proceedings of international workshop on B-factories: accelerators and experiments (BFWS92).* 435p. Order Number DE94737962. Source: OSTI; NTIS; INIS.

This paper describes the development of an RF cavity design for the proposed PEP-II asymmetric B factory. The high luminosity required of PEP-II provides challenges in the design of the RF cavities, most notably in the reduced higher-order mode (HOM) impedances that must be attained and in the power that must be dissipated in the cavity walls. This paper outlines the goals set in these regards, describes how the cavity has been developed to meet them, and presents the results of measurements on a low-power test model built to verify the HOM damping scheme. (author).

28223 (KEK-PROC–93-7, pp. 133-139) **Superconducting RF for CESR-B; recent progress at cornell.** Padamsee, H. (Cornell Univ., Ithaca, NY (United States). Newman Lab. of Nuclear Studies); Akai, K.; Barnes, P. National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan). Jun 1993. (CONF-9211172–: International workshop on B factories: accelerators and experiments,

Tsukuba (Japan), 17-20 Nov 1992). In *Proceedings of international workshop on B-factories: accelerators and experiments (BFWS92).* 435p. Order Number DE94737962. Source: OSTI; NTIS; INIS.

This paper is an update on the development at Cornell of superconducting cavities for high current B-factories. (author).

28224 (KEK-PROC–93-7, pp. 140-144) **Superconducting cavity development for KEK B-factory.** Mitsunobu, S. (National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan)); Asano, K.; Furuya, T.; Ohara, M.; Tajima, T.; Takahashi, T.; Ishi, Y.; Kijima, Y. National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan). Jun 1993. (CONF-9211172–: International workshop on B factories: accelerators and experiments, Tsukuba (Japan), 17-20 Nov 1992). In *Proceedings of international workshop on B-factories: accelerators and experiments (BFWS92).* 435p. Order Number DE94737962. Source: OSTI; NTIS; INIS.

KEK B-Factory is an asymmetric-energy electron-positron collider to detect the CP violation of B-mesons. If the Kobayashi-Masukawa model is a correct description of nature, we can expect sizable CP-violation effect in several B-meson decay channels; however, the branching ratio of the decay channels are rather small and we should have a collider with 2-10x10^{33} $cm^{-2}s^{-1}$ luminosity. The luminosity goal of the KEK B-Factory is 10^{34} $cm^{-2}s^{-1}$, which will be realized by storing 2.6 A in the low-energy (positron) ring and 1.1 A in the high-energy (electron) ring. Superconducting cavities for the B-Factory should be of single-cell type, since damping of HOMs is easiest and the input-coupler load can be minimized. To prevent coupled-bunch instabilities, Q values of HOMs should be made lower than $\approx$100. Table 1 summarizes parameters of the superconducting cavity system of the KEK B-Factory. (J.P.N.).

28225 (KEK-PROC–93-7, pp. 167-174) **Bunch-by-bunch feedback for PEP II.** Oxoby, G. (Stanford Linear Accelerator Center, CA (United States)); Claus, R.; Eisen, N.; Fox, J.; Hindi, H.; Hoeflich, J.; Olsen, J.; Sapozhnikov, L.; Linscott, I. National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan). Jun 1993. (CONF-9211172–: International workshop on B factories: accelerators and experiments, Tsukuba (Japan), 17-20 Nov 1992). In *Proceedings of international workshop on B-factories: accelerators and experiments (BFWS92).* 435p. Order Number DE94737962. Source: OSTI; NTIS; INIS.

The proposed PEP II B factory at SLAC requires a feedback to damp out longitudinal synchrotron oscillations. A time domain, downsampled, bunch-by-bunch feedback system in which each bunching is treated as an oscillator being driven by disturbances from other bunches is presented as we review the evolution of the system design. Results from a synchrotron oscillation damping experiment conducted at the SLAC/SSRL/SPEAR ring are also presented in this paper. (author).

28226 (KEK-PROC–93-7, pp. 175-178) **Bunch feedback systems.** Kikutani, Eiji (National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan)); Katsura, Tomotaro; Obina, Takashi; Kasuga, Toshio; Tobiyama, Makoto. National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan). Jun 1993. (CONF-9211172–: International workshop on B factories: accelerators and experiments, Tsukuba (Japan), 17-20 Nov 1992). In *Proceedings of international workshop on B-factories: accelerators and experiments (BFWS92).* 435p. Order Number DE94737962. Source: OSTI; NTIS; INIS.

Guidelines on designing a bunch feedback system is given. Also the R and D program to developing the hardware for the feedback system is discussed. (author).

28227 (KEK-PROC–93-7, pp. 182-188) **Bunch-motion feedback for B-factories.** Lambertson, G.R. (Lawrence Berkeley Lab., CA (United States)). National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan). Jun 1993. (CONF-9211172–: International workshop on B factories: accelerators and experiments, Tsukuba (Japan), 17-20 Nov 1992). In *Proceedings of international workshop on B-factories: accelerators and experiments (BFWS92).* 435p. Order Number DE94737962. Source: OSTI; NTIS; INIS.

With many bunches and high current in the B-factory many hundreds of coupled-bunch modes will be unstable. To suppress the growth of all modes requires feedback systems with bandwidth at least one-half the bunch rate, a few hundred MHz. Reduction of the impedances of rf cavity modes is necessary to make feedback practical, and in the longitudinal case to make it feasible. Real-time bunch-by-bunch feedback can stabilize the bunch motions and damp injection errors and other disturbances. Digital processors can provide the required data rate and the needed time-delays and phase shift. For economy it is desirable to limit the kicker power and operate in the non-linear range in response to the large errors in injected beam. Schemes that inject beam batches with a small product of charge x error are most readily controllable. For the transverse motions, the resistive-wall impedance produces the fastest growth rates after cavity modes are reduced by a factor of several hundred. Longitudinal motions have an additional excitation from the shoulders of the r.f. fundamental mode. This must be reduced with fast rf feedback through the klystron and supplemental gain in the bunch-motion feedback for low-frequency modes. Some special design of the kickers for the broad-band feedback will save on system costs. (J.P.N.).

28228 (KEK-PROC–93-7, pp. 189-194) **Vacuum system for KEK B-factory.** Suetsugu, Yusuke (National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan)); Kanazawa, Ken-ichi. National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan). Jun 1993. (CONF-9211172–: International workshop on B factories: accelerators and experiments, Tsukuba (Japan), 17-20 Nov 1992). In *Proceedings of international workshop on B-factories: accelerators and experiments (BFWS92).* 435p. Order Number DE94737962. Source: OSTI; NTIS; INIS.

The design of vacuum system for KEK B-factory has been advanced steadily. The overall design was completed. The goal pressure, $\approx 10^{-9}$ Torr, will be obtained by a traditional pumping scheme. Resent R and D works have been concentrated on the realization of copper beam duct. A fabrication of copper duct was tried and go satisfactory results. Vacuum conditioning process was simulated and advantages of copper duct over aluminum one were confirmed. A major remained difficulty for copper duct is a high fabrication cost. (author).

28229 (KEK-PROC–93-7, pp. 195-203) **Research and development for the PEP-II vacuum system.** Perkins, C. (Stanford Linear Accelerator Center, CA (United States)). National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan). Jun 1993. (CONF-9211172–: International workshop on B factories: accelerators and experiments, Tsukuba (Japan), 17-20 Nov 1992). In *Proceedings of international workshop on B-factories: accelerators and experiments (BFWS92).* 435p. Order Number DE94737962. Source: OSTI; NTIS; INIS.

Significant research and development activities have been carried out during the past year to optimize the vacuum system design for the SLAC-LBL-LLNL PEP-II B Factory. Detailed evaluations of design, materials, and manufacturing are reported, and the resulting changes from the original CDR design are described. Results of vacuum, thermal, and mechanical analyses are presented, and their relationship to machine performance requirements detailed. The results of extensive manufacturing prototype testing, which verify the proposed design concepts, are reported. (author).

28230 (KEK-PROC–93-7, pp. 204-208) **Hybrid Cu-Al beam pipe for KEK B factory.** Ishimaru, Hajime (National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan)); Momose, Takashi; Suetsugu, Yusuke; Hirayama, Hideo. National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan). Jun 1993. (CONF-9211172–: International workshop on B factories: accelerators and experiments, Tsukuba (Japan), 17-20 Nov 1992). In *Proceedings of international workshop on B-factories: accelerators and experiments (BFWS92).* 435p. Order Number DE94737962. Source: OSTI; NTIS; INIS.

Hybrid Cu-Al beam pipe is proposed for KEK B factory. The pipe is based on the idea that better characteristics of each material are utilized to obtain lower cost and photodesorption yield comparable to that of all copper vacuum beam pipe. Copper is set to the part irradiated directly with photons of synchrotron radiation and aluminum alloy is set to the part irradiated with reflected photons of synchrotron radiation. A fabricated model of the hybrid Cu-Al beam pipe is shown and can be realized using trivial technique. For the present, measured desorption yield of aluminum alloy is evaluated about 5 times higher than that of copper. Using the value, estimated photodesorption yield is about 3 times higher than that of all copper beam pipe at the photon dose larger than 10^{21} photons/m.

The photodesorption yield of the aluminum alloy must be reduced and the several methods are suggested to obtain a comparable yield with copper. The estimated radiation outside of the hybrid beam pipe in the normal bending section for high energy ring and low energy ring for KEK B factory is comparable and wiggler section needs one order of magnitude dense shield compared with that of TRISTAN accumulation ring. Estimated cost of the hybrid beam pipe is one third of all copper beam pipe and is 0.6 million yen per meter. (author).

28231 (KEK-PROC–93-7, pp. 209-210) **Test of copper duct at PF.** Kobayashi, M. (National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan)); Hori, Y. National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan). Jun 1993. (CONF-9211172–: International workshop on B factories: accelerators and experiments, Tsukuba (Japan), 17-20 Nov 1992). In *Proceedings of international workshop on B-factories: accelerators and experiments (BFWS92).* 435p. Order Number DE94737962. Source: OSTI; NTIS; INIS.

Short communication. VACUUM SYSTEMS/kek photon factory; KEK PHOTON FACTORY/vacuum systems; MATERIALS; COPPER; SHIELDING; X RADIATION; PERFORMANCE TESTING; DEGASSING; SYNCHROTRON RADIATION

28232 (KEK-PROC–93-7, pp. 216-220) **Linac upgrade plan for the KEK B-factory.** Enomoto, A. (National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan)). National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan). Jun 1993. (CONF-9211172–: International workshop on B factories: accelerators and experiments, Tsukuba (Japan), 17-20 Nov 1992). In *Proceedings of international workshop on B-factories: accelerators and experiments (BFWS92).* 435p. Order Number DE94737962. Source: OSTI; NTIS; INIS.

The upgrade plan for the KEK 2.5-GeV linac is discussed. In order to increase the linac energy from 2.5 GeV to 8 GeV, accelerator structures using a traveling-wave resonant ring and the SLED system are both being studied. The activities regarding the injector linac division and future plans are described. (author).

28233 (KEK-PROC–93-7, pp. 229-234) **Interaction region design for the PEP II upgrade.** Sullivan, M.K. (Stanford Linear Accelerators Center, CA (United States)). National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan). Jun 1993. (CONF-9211172–: International workshop on B factories: accelerators and experiments, Tsukuba (Japan), 17-20 Nov 1992). In *Proceedings of international workshop on B-factories: accelerators and experiments (BFWS92).* 435p. Order Number DE94737962. Source: OSTI; NTIS; INIS.

The interaction region design for the SLAC-LBL-LLNL B factory is summarized. Requirements and constraints from both the machine and the detector that have an influence on the interaction region design are presented. It is argued that the production of synchrotron radiation from nearby machine elements is an important design constraint of the interaction region. (author).

28234 (KEK-PROC–93-7, pp. 239-252) **CESR/CLEO phase-II IR upgrade.** Yamamoto, Hitoshi (Harvard Univ., Cambridge, MA (United States)). National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan). Jun 1993. (CONF-9211172–: International workshop on B factories: accelerators and experiments, Tsukuba (Japan), 17-20 Nov 1992). In *Proceedings of international workshop on B-factories: accelerators and experiments (BFWS92).* 435p. Order Number DE94737962. Source: OSTI; NTIS; INIS.

We are planning to install a new interaction region (IR) in 1994 associated with a luminosity upgrade and installation of a silicon vertex detector. Critical elements of the new IR include a water-cooled Beryllium beampipe, and a set of masks to shield the central detector section from beam-generated background radiation. The new mask design is based on a good understanding of the background in the current configuration. (author).

28235 (KEK-PROC–93-7, pp. 253-255) **Design of an active shield dipole magnet in the interaction region of KEK B-factory.** Kobayashi, T.M. (National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan)); Tsuchiya, K.; Ohuchi, N.; Haruyama, T.; Ajima, Y.; Doi, Y.; Kurokawa, S.; Kimura, A. National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan). Jun 1993. (CONF-9211172–: International workshop on B factories: accelerators and experiments, Tsukuba (Japan), 17-20 Nov 1992). In *Proceedings of international workshop on B-factories: accelerators and experiments (BFWS92).* 435p. Order Number DE94737962. Source: OSTI; NTIS; INIS.

An active shield dipole magnet was designed for the asymmetric two-ring electron-positron collider, KEK B-Factory. It is an iron-free magnet with a central field of 0.7T and an effective length of 0.4m. Since the magnet should be positioned as close to the interaction point as possible, it is very important to reduce the leakage field outside of the magnet in order not to disturb the solenoid field of the detector magnet. By using an active shield coil, it could be possible to suppress the leakage field to the level of 0.005T outside of the radius of 0.2m. (author).

28236 (KEK-PROC–93-7, pp. 257-262) **Data acquisition system for KEK B-factory.** Tsukamoto, Toshifumi (National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan)). National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan). Jun 1993. (CONF-9211172–: International workshop on B factories: accelerators and experiments, Tsukuba (Japan), 17-20 Nov 1992). In *Proceedings of international workshop on B-factories: accelerators and experiments (BFWS92).* 435p. Order Number DE94737962. Source: OSTI; NTIS; INIS.

The data acquisition system proposed for KEK B-factory is presented. First the requirement of the system is shown, and the general scheme is described with mentioning the difference between the systems designed for KEK and SLAC B-factory. And then the status of the R and D's for SAW delay lines, event builders and softwares are presented. (author).

28237 (KEK-PROC–93-7, pp. 263-270) **Trigger system for KEK B-factory.** Sakai, Yoshihide (National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan)). National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan). Jun 1993. (CONF-9211172–: International workshop on B factories: accelerators and experiments, Tsukuba (Japan), 17-20 Nov 1992). In *Proceedings of international workshop on B-factories: accelerators and experiments (BFWS92).* 435p. Order Number DE94737962. Source: OSTI; NTIS; INIS.

Requirements and general design for trigger system for KEK B-Factory are briefly reviewed. KEK design is based on the synchronous trigger system with readout signal being delayed by delay-lines or stored analog/pipelined memory by trigger decision time. A current status of design is reported for some of the detector components. A potential problems and solutions are also discussed. (author).

28238 (KEK-PROC–93-7, pp. 277-280) **BB-barQ-computer farm for KEK B-factory.** Itoh, Ryosuke (National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan)). National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan). Jun 1993. (CONF-9211172–: International workshop on B factories: accelerators and experiments, Tsukuba (Japan), 17-20 Nov 1992). In *Proceedings of international workshop on B-factories: accelerators and experiments (BFWS92).* 435p. Order Number DE94737962. Source: OSTI; NTIS; INIS.

A large computing system was developed to be used for the on-line data reduction in the planned KEK B-factory experiment. The performance of the system was measured to be more than 1500 VAX equivalent. (author).

28239 (KEK-PROC–93-7, pp. 292-303) **Detector simulations for KEK B-factory.** Nozaki, Tadao (National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan)). National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan). Jun 1993. (CONF-9211172–: International workshop on B factories: accelerators and experiments, Tsukuba (Japan), 17-20 Nov 1992). In *Proceedings of international workshop on B-factories: accelerators and experiments (BFWS92).* 435p. Order Number DE94737962. Source: OSTI; NTIS; INIS.

The status of the full simulation program for the KEK B-Factory detector is reported. Also reported is the status of the event reconstruction program, in particular, some results obtained by the reconstruction of the tracking detector data are shown. Finally future prospects of the simulation and analysis programs are given. (author).

28240 (KEK-PROC–93-7, pp. 326-330) **Present status of the 'fast RICH project'.** Sumiyoshi, Takayuki (National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan)). National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan). Jun 1993. (CONF-9211172–: International workshop on B factories: accelerators and experiments, Tsukuba (Japan), 17-20 Nov 1992). In *Proceedings of international workshop on B-factories: accelerators and experiments (BFWS92).* 435p. Order Number DE94737962. Source: OSTI; NTIS; INIS.

Present status of the 'Fast RICH Project' is presented. The construction of the prototype FAST RICH has been almost finished. The readout electronics, 8 ch. analog and 16 ch. digital chips, have been proven to work as expected. With a UV light source, detector response for a single photo-electron was checked and was found to have an excellent performance with a very low noise. The total performance will be tested in near future by a cosmic ray and a beam test. (author).

28241 (KEK-PROC–93-7, pp. 350-355) **Design and test of cathode strip readout.** Sugiyama, Akira (Nagoya Univ. (Japan). Dept. of Physics). National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan). Jun 1993. (CONF-9211172–: International workshop on B factories: accelerators and experiments, Tsukuba (Japan), 17-20 Nov 1992). In *Proceedings of international workshop on B-factories: accelerators and experiments (BFWS92).* 435p. Order Number DE94737962. Source: OSTI; NTIS; INIS.

Cathode readout performance has been studies on small cell drift chamber operated with He/C_2H_6 fast and low material gas mixture. Obtained cathode resolution satisfy the requirement (500 μm) for incident angle greater than 50deg. Systematic study of resolution is considered to improve the resolution at the region of incident angle smaller than 50deg. Off line study with simulated cathode pulse height assures the ability of Z trigger and Z position information under 8 segmentation of strips along ϕ direction. (author).

28242 (LAL-RT–93-14) **Analytical approach and scaling laws in the design of disk-loaded travelling wave accelerating structures.** Gao, J. Paris-11 Univ., 91 - Orsay (France). Lab. de l'Accelerateur Lineaire. Sep 1993. 22p. (CONF-9307191–: S-band linear collider meeting, Hamburg (Germany), 7-8 Jul 1993). Order Number DE94632546. Source: OSTI; NTIS (US Sales Only); INIS.

Submitted to Particle Accelerators (CH).

Starting from a single resonant rf cavity, disk-loaded travelling (forward or backward) wave accelerating structures' properties are determined by rather simple analytical formulae. They include the coupling coefficient K in the dispersion relation, group velocity v_g, shunt impedance R, wake potential W (longitudinal and transverse), the coupling coefficient β of the coupler cavity and the coupler cavity axis shift δ_r which is introduced to compensate the asymmetry caused by the coupling aperture. (author) 12 refs., 18 figs.

28243 (LBL–35459) **Radiation problems in the design of a radioactive nuclear beam facility.** Donahue, R.J. (Lawrence Berkeley Lab., CA (United States)); Nitschke, J.M.; Stoyer, M.A.; Moeller, G.C. Lawrence Berkeley Lab., CA (United States). Apr 1994. 20p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00098. (CONF-9404150–2: Specialist's meeting on shielding aspects of accelerators, targets and irradiation facilities, Arlington, TX (United States), 28-29 Apr 1994). Order Number DE94014963. Source: OSTI; NTIS; INIS; GPO Dep.

Radioactive Nuclear Beam (RNB) facilities are proposed or under construction in North America, Japan, Russia, and in Europe. The front ends of these facilities are very similar to intense neutron spallation sources in that they require approximately 1 GeV, $\geq$ 100 μA proton beams incident on thick high-Z targets, possibly including enriched uranium. This paper will summarize some of the radiation transport modeling problems and solutions encountered in the preconceptual design of such a facility. Issues to be addressed include Monte Carlo and discrete ordinates modeling of deep penetration shielding, target heating and residual mass yields. Comparisons are made between empirical data (Tsao and Silberberg), when available, and computer codes (FLUKA, LAHET, TWODANT). Suggestions are made for further improvement and development of existing models and experimental measurements.

28244 **Inclined monochromator for high heat-load synchrotron x-ray radiation.** Khounsary, A.M. To Dept. of Energy. 1992. Filed date 6 Jul 1992. U.S. Patent Application 7-909,323. 29p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. Order Number DE94016142. Source: OSTI; NTIS; INIS; GPO Dep.

A double crystal monochromator including two identical, parallel crystals, each of which is cut such that the normal to the diffraction planes of interest makes an angle less than 90 degrees with the surface normal. Diffraction is symmetric, regardless of whether the crystals are symmetrically or asymmetrically cut, enabling operation of the monochromator with a fixed plane of diffraction. As a result of the inclination of the crystal surface, an incident beam has a footprint area which is elongated both vertically and horizontally when compared to that of the-conventional monochromator, reducing the heat flux of the incident beam and enabling more efficient surface cooling. Because after inclination of the crystal only a fraction of thermal distortion lies in the diffraction plane, slope errors and the resultant misorientation of the diffracted beam are reduced.

28245 **Mode trap.** Chojnacki, E.P. To Dept. of Energy. 1992. Filed date 24 Aug 1992. U.S. Patent Application 7-924,991. 17p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. Order Number DE94016125. Source: OSTI; NTIS; INIS; GPO Dep.

This report discusses a mode trap to trap and absorb transverse modes formed by a beam in a linear accelerator includes a waveguide having a multiplicity of electrically conductive (preferably copper) irises and rings, each iris and ring including an aperture, and the irises and rings being stacked in a side-by-side, alternating fashion such that the apertures of the irises and rings are concentrically aligned. An absorbing material layer such as a dielectric is embedded in each iris and ring, and this absorbing material layer encircles, but is circumferentially spaced from its respective aperture. Each iris and ring includes a plurality of circumferentially spaced slots around it's aperture and extending radially out toward it's absorbing material layer.

28246 (SAND–93-3838C) **Results of the first 2-stage diode experiments on PBFA II.** Lockner, T.; Slutz, S.; Johnson, D.J.; Desjarlais, M.; Poukey, J. Sandia National Labs., Albuquerque, NM (United States). [1994]. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. (CONF-940634–11: 10. international conference on high power particle beams, San Diego, CA (United States), 20-24 Jun 1994). Order Number DE94015766. Source: OSTI; NTIS; INIS; GPO Dep.

A series of experiments have been performed on the PBFA II accelerator in a 2-Stage diode configuration. These experiments have demonstrated the generation and post acceleration of both proton and lithium beams. The second stage was also used to measure the ion current injected from the first stage. The ion current was found to be larger than the inferred current from Faraday cup measurements as is seen in single stage experiments. This result suggests that the current difference (known as parasitic load) is carried by ions. A straightforward modification to the poor magnetic field geometry in the second stage is shown to improve transport to the axis.

28247 (TRI-PP–91-17) **Results of calculations on the beam deflection due to the 1 MHz chopper for the Kaon factory.** Barnes, M.J.; Wait, G.D. TRIUMF, Vancouver, BC (Canada). May 1991. 3p. (CONF-910505–: 1991 Institute of Electrical and Electronics Engineers (IEEE) particle accelerator conference (PAC), San Francisco, CA (United States), 6-11 May 1991). Order Number DE94632558. Source: OSTI; NTIS (US Sales Only); INIS.

Deflection of 1 GeV/c H^- beam bunches to be eliminated by the 1 MHz chopper, for the proposed Kaon factory at TRIUMF, will be provided by an electric field between a set of deflector plates. Deflection rise time is a function of beam transit time through the deflector plates and the rise time of the stored voltage pulse. This paper presents the results of time-domain mathematical simulations to assess the relationship between the above quantities: the results of these simulations allow an accurate determination of the required rise-time of the stored voltage pulse. The representation of the deflector plates is modified so that linear displacement of the beam, as well as angular deflection, may be assessed. Simulations

have also been performed to assess the attenuating effect of the deflector plates upon both angular deflection and linear displacement of the H^- beam caused by voltage ripple. A measured voltage pulse is simulated as driving the deflector plates, and beam deflection is predicted. (Author) 12 refs., 3 figs.

28248 (TRI-PP–91-18) **Algorithm for the deflector plates of the 1 MHz chopper for the Kaon factory.** Barnes, M.J.; Wait, G.D. TRIUMF, Vancouver, BC (Canada). May 1991. 3p. (CONF-910505–: 1991 Institute of Electrical and Electronics Engineers (IEEE) particle accelerator conference (PAC), San Francisco, CA (United States), 6-11 May 1991). Order Number DE94632559. Source: OSTI; NTIS (US Sales Only); INIS.

The Kaon Factory at TRIUMF requires a 1 MHz chopper to create appropriate gaps in the extracted 1 GeV/c H^- beam from the cyclotron. Deflection of bunches to be eliminated by the 1 MHz chopper will be predominantly provided by an electric field between a set of deflector plates, although there will be a magnetic component of deflection too. Previous simulations to calculate angular deflection of beam particles in the deflector plates approximated the plates as 8 sections, and only considered plates of one length. This paper presents the results of time-domain mathematical simulations to assess errors introduced by approximating the deflector plates using a finite number of sections. In order to validate the mathematical model of the deflector plates the predictions are compared with analytical equations for angular deflection for the situation where centre-fed plates are energized by a 'step-function'. Predictions of angular deflection are presented for four configurations of deflector plates in order to confirm that centre-feeding is the best option considered. (Author) 9 refs., 4 figs.

28249 (TRI-PP–91-19) **Analysis of eddy currents in the walls of the ferrite tuned RF cavity for the TRIUMF Kaon factory booster synchrotron.** Enchevich, I.B. (Sofia Univ. (Bulgaria)); Barnes, M.J.; Poirier, R.L. TRIUMF, Vancouver, BC (Canada). May 1991. 3p. (CONF-910505–: 1991 Institute of Electrical and Electronics Engineers (IEEE) particle accelerator conference (PAC), San Francisco, CA (United States), 6-11 May 1991). Order Number DE94632560. Source: OSTI; NTIS (US Sales Only); INIS.

In the perpendicular biased ferrite tuned cavity of the proposed TRIUMF Kaon Factory Booster Synchrotron, magnetizing flux passes through the cavity walls. If special care is not taken to minimize eddy current loss in the walls, the dissipated power would be excessive and the magnetic fields set up by the eddy currents would disturb the magnetic field being applied. By electrically isolating the cooling structure from the cavity walls and introducing slots in the walls it is possible to bring to an acceptable level both the power loss and the maximal temperatures. Based on the measurements, an analytical model - essentially 3D - was derived and the eddy currents were predicted using the circuit analysis program PSpice. The calculated surface current and power distribution agree with measurements. PSpice can now be used to determine the effect of design changes on the eddy current and power distribution. (Author) 7 refs., 5 figs.

28250 (TRI-PP–91-20) **Ceramic beam pipe for the TRIUMF KAON factory synchrotron rings.** Hodges, T. (TRIUMF, Vancouver, BC (Canada)); Langstaff, R.; Oram, C.; Featherby, M.; Planner, C. TRIUMF, Vancouver, BC (Canada). May 1991. 3p. (CONF-910505–: 1991 Institute of Electrical and Electronics Engineers (IEEE) particle accelerator conference (PAC), San Francisco, CA (United States), 6-11 May 1991). Order Number DE94632561. Source: OSTI; NTIS (US Sales Only); INIS.

The sections of beam pipe passing through the magnets of the two fast cycling synchrotrons of the KAON Factory accelerator are to be constructed of alumina, thereby avoiding the eddy current problems which would otherwise arise if conventional metal pipes were used. An rf shield is required inside the nonconducting ceramic pipe to provide a low impedance path for the image currents of the circulating beam. Two schemes using different construction techniques for both the ceramic pipe and the internal rf shield are described and compared. (Author) 2 figs.

28251 (TRI-PP–91-21) **Calculation of seed values for longitudinal coupled bunch dipole instability due to uneven bucket population.** Koscielniak, S.R. TRIUMF, Vancouver, BC (Canada). May 1991. 3p. (CONF-910505–: 1991 Institute of Electrical and Electronics Engineers (IEEE) particle accelerator conference (PAC), San Francisco, CA (United States), 6-11 May 1991). Order Number DE94632562. Source: OSTI; NTIS (US Sales Only); INIS.

Conventionally, the starting amplitude (or 'seed') for bunched beam coherent oscillations is assumed independent of the steady state Fourier components of the beam, and is attributed to imperfect technology of randomness. However, there are occasions when the dominant component of the seeds derive from the transient response of the impedance to the revolution harmonics. Such harmonics are caused by uneven bucket population. In this paper we find the beam response to sweeping the radio frequency through a cavity parasitic resonance in order to calculate the increases in the individual bunch dipole moments and the coupled-bunch oscillation amplitude. In the KAON Booster, an hypothetical first HOM with Q = 4000 and R/Q = 30 gives a coupled-bunch dipole oscillation of 27 degrees of rf phase; which would swamp any injection timing errors. (Author) 4 refs.

28252 (TRI-PP–91-22) **Calculation of required tuner accuracy and bandwidth with and without fast feedback.** Koscielniak, S.R. TRIUMF, Vancouver, BC (Canada). May 1991. 3p. (CONF-910505–: 1991 Institute of Electrical and Electronics Engineers (IEEE) particle accelerator conference (PAC), San Francisco, CA (United States), 6-11 May 1991). Order Number DE94632563. Source: OSTI; NTIS (US Sales Only); INIS.

An expression for the resonance-controller time constant is given in terms of the allowed tuner error and rate of frequency sweep. A cavity tuner-control with this time-constant guarantees the resonance program is tracked to the desired accuracy. Expressions are given for the permissible tuner frequency error, in terms of the reactive to resistive power ratio, for an accelerating cavity operating with or without fast feedback. An expression is given for the resonance frequency sweep rate for arbitrary drive frequency program and relative beam-loading. The results are applied to the TRIUMF-KAON accumulator and booster rings. The constraint imposed on the time constant by accumulation in the former is not severe; a passband of a few hundred Hertz is sufficient. However, it is found that in the absence of fast feedback the booster tuner control must have a passband that extends to 30 kHz. This paper is an abridged version of an unpublished design note. (Author) 4 refs., fig.

28253 (TRI-PP–91-24) **Compensation of RF transients during injection into the collector ring of the TRIUMF KAON factory.** Koscielniak, S.R. (TRIUMF, Vancouver, BC (Canada)); Wang, T.S. TRIUMF, Vancouver, BC (Canada). May 1991. 3p. (CONF-910505–: 1991 Institute of Electrical and Electronics Engineers (IEEE) particle accelerator conference (PAC), San Francisco, CA (United States), 6-11 May 1991). Order Number DE94632542. Source: OSTI; NTIS (US Sales Only); INIS.

The collector ring in the KAON Factory proposed at TRIUMF is designed to accumulate five 3 GeV proton pulses in order to match the time cycles of booster (50 Hz) and driver (10 Hz). The averaged beam current in the ring varies in steps at the injection of each pulse from booster. RF cavities need to be retuned at every injection to maintain the proper bunching voltage as well as the phase relation between the cavity voltage and the beam current. Since the collector will be heavily beam-loaded and cavity tuning will be slow compared with jumps in beam current, each injection is expected to cause substantial disturbance to the cavity voltage and to the beam. The disturbance is called an injection transient. This paper studies possible control schemes of the RF system during the injection period in the collector by using an equivalent circuit model and numerical solutions of the coupled nonlinear differential equations. The simulations are used to suggest suitable values for the fast feedback gain and the peak tuning rate. This paper is an abridged version of a design note. (Author) 4 refs., 5 figs.

28254 (TRI-PP–91-26) **Magnets for TRIUMF's KAON factory.** Otter, A.J.; Reeve, P.A. TRIUMF, Vancouver, BC (Canada). May 1991. 3p. (CONF-910505–: 1991 Institute of Electrical and Electronics Engineers (IEEE) particle accelerator conference (PAC), San Francisco, CA (United States), 6-11 May 1991). Order Number DE94632549. Source: OSTI; NTIS (US Sales Only); INIS.

The KAON Factory will require over 2000 magnets to transport protons from the existing 500 Mev cyclotron through three storage

rings and two synchrotrons and deliver them to the experimental area at 30 Gev. The magnet requirements are summarized and the results of measurements on prototypes for the 50 hz Booster magnets are compared with design values. This paper will address three topics: the results of prototype work, some of the more difficult design aspects of other magnets and the tolerances required to achieve production magnets uniform to $\pm$ 2 parts in 10^4. (Author) 10 refs., 3 figs., tab.

28255 (TRI-PP–91-27) **AC bias operation of the perpendicular biased ferrite tuned cavity for the TRIUMF KAON Factory booster synchrotron.** Poirier, R.L. (TRIUMF, Vancouver, BC (Canada)); Enegren, T.A.; Enchevich, I.B. TRIUMF, Vancouver, BC (Canada). May 1991. 3p. (CONF-910505–: 1991 Institute of Electrical and Electronics Engineers (IEEE) particle accelerator conference (PAC), San Francisco, CA (United States), 6-11 May 1991). Order Number DE94632564. Source: OSTI; NTIS (US Sales Only); INIS.

The RF cavity for the booster synchrotron requires a frequency swing from 46 MHz at a repetition rate of 50 Hz and a maximum accelerating gap voltage of 65 kV. A DC biased prototype cavity built at LANL using perpendicular-biased yttrium-garnet ferrites, rather than the more conventional parallel-biased NiZn ferrites, has now undergone major reconstruction at TRIUMF for AC bias operation. RF signal level measurements have shown that the frequency swing at a repetition rate of 50 Hz can be accomplished and still handle the eddy current losses in the cavity structures with minimal effect on the magnetizing field. The prototype cavity is now undergoing high power RF tests with full power AC bias operation. The results of these tests and operational experience is reported. (Author) ref., 6 figs.

28256 (TRI-PP–91-28) **Power supply system for the TRIUMF KAON factory.** Reiniger, K.W. TRIUMF, Vancouver, BC (Canada). May 1991. 3p. (CONF-910505–: 1991 Institute of Electrical and Electronics Engineers (IEEE) particle accelerator conference (PAC), San Francisco, CA (United States), 6-11 May 1991). Order Number DE94632550. Source: OSTI; NTIS (US Sales Only); INIS.

The TRIUMF KAON Factory consists of 5 rings, 3 of which are dc powered and 2 synchrotrons running at 50 Hz and 10 Hz, respectively. This paper deals with the power supply system envisaged for the accelerator as well as the experimental results obtained using dc-biased single and dual frequency resonant magnet excitation for the booster and driver synchrotrons. (Author) 6 refs., 8 figs.

28257 (TRI-PP–91-30) **Prototype studies of a 1 MHz chopper for the KAON Factory.** Wait, G.D. (TRIUMF, Vancouver, BC (Canada)); Barnes, M.J.; Bishop, D.; Waters, G.; Figley, C.B. TRIUMF, Vancouver, BC (Canada). May 1991. 3p. (CONF-910505–: 1991 Institute of Electrical and Electronics Engineers (IEEE) particle accelerator conference (PAC), San Francisco, CA (United States), 6-11 May 1991). Order Number DE94632543. Source: OSTI; NTIS (US Sales Only); INIS.

A 1.025 MHz ($\simeq 10^6$ discrete pulses/s) beam chopper is required for the injection line into the accumulator ring of the KAON Factory at TRIUMF. The beam chopper will create 108 ns gaps in the 1 GeV/c H^- beam to allow enough time for the magnetic field to be established in the kicker magnets in each of the 5 rings. The required deflection of 1 mrad can be achieved with a set of plates 5 cm apart in which the product of voltage difference and plate length is 37.7 kV.m. The 'kick' must have a rise and fall time of less than 39 ns and a flat top of 49 ns on alternate pulses. A novel design concept for a 1 MHz chopper has been developed involving an energy storage system where the electric pulses are stored in a large diameter (10 cm) low loss coaxial cable. Measurements on the performance of a high voltage prototype are presented. Results are encouraging and show that this novel design can be implemented successfully for the KAON Factory. (Author) 11 refs., 6 figs., tab.

28258 (TRI-PP–91-31) **Controls and interlocks for a prototype 1MHz beam chopper.** Waters, G.; Bishop, D.; Barnes, M.J.; Wait, G.D. TRIUMF, Vancouver, BC (Canada). May 1991. 3p. (CONF-910505–: 1991 Institute of Electrical and Electronics Engineers (IEEE) particle accelerator conference (PAC), San Francisco, CA (United States), 6-11 May 1991). Order Number DE94632544. Source: OSTI; NTIS (US Sales Only); INIS.

A prototype 1 MHz beam chopper for the proposed KAON Factory at TRIUMF has been constructed. The chopper is an electric field device, driven by a tetrode based pulser, for deflecting a charged particle beam. Associated with the tetrode used in the prototype design are high voltage power supplies for the electrodes. We use an FET based grid pulser and a sequencer capable of accurate digital control of pulse timing to 0.4 ns. A safety interlock and control system using a programmable controller with fibre optic links has been built. This has given us the versatility required in a prototype system. (Author) 4 refs., 5 figs.

28259 (TRI-PP–91-32) **Development of a wall current beam position monitor for a KAON Factory ceramic chamber.** Yin, Y.; Rawnsley, B.; Mackensie, G.; Pearce, D.; Worden, J. TRIUMF, Vancouver, BC (Canada). May 1991. 3p. (CONF-910505–: 1991 Institute of Electrical and Electronics Engineers (IEEE) particle accelerator conference (PAC), San Francisco, CA (United States), 6-11 May 1991). Order Number DE94632565. Source: OSTI; NTIS (US Sales Only); INIS.

The rapid cycling synchrotron proposed for the TRIUMF KAON Factory uses ceramic beam pipe to suppress eddy currents. One design has metallic strips fixed onto the inner surface to carry the wall currents. A beam position monitor has been designed using these strips and tested successfully with the TRIUMF cyclotron beam. (Author) 5 refs., 7 figs.

28260 (TRI-PP–91-33) **Measurement of longitudinal impedance for a KAON test pipe model with TSD-calibration method.** Yin, Y. (TRIUMF, Vancouver, BC (Canada)); Oram, C.; Ilinsky, N.; Reinhardt-Nikulin, P. TRIUMF, Vancouver, BC (Canada). May 1991. 3p. (CONF-910505–: 1991 Institute of Electrical and Electronics Engineers (IEEE) particle accelerator conference (PAC), San Francisco, CA (United States), 6-11 May 1991). Order Number DE94632551. Source: OSTI; NTIS (US Sales Only); INIS.

We report measurements of longitudinal impedances for a KAON factory beam pipe model by means of the TSD-calibration method. The experimental method and the results are discussed. The frequency band is from 48 MHz up to 900 MHz, within which range the method produces measured impedances accurate enough to be useful in indicating whether a test pipe will have a suitably low impedance. (Author) 9 refs., 7 figs.

28261 (TRI-PP–91-35) **Commissioning and first operation of a 500 μA, 30 MeV, H^- cyclotron: The TR30.** Milton, B.F. (TRIUMF, Vancouver, BC (Canada)); Dutto, G.; Schmor, P.W.; Schneider, H.R.; Dawson, R.; Erdman, K.L.; Gyles, W.; Sample, J.; Walker, Q. TRIUMF, Vancouver, BC (Canada). May 1991. 3p. (CONF-910505–: 1991 Institute of Electrical and Electronics Engineers (IEEE) particle accelerator conference (PAC), San Francisco, CA (United States), 6-11 May 1991). Order Number DE94632566. Source: OSTI; NTIS (US Sales Only); INIS.

A new high intensity, 30 MeV H^- cyclotron has been constructed by Ebco Technologies Ltd. for NORDION International to be used for radioisotope production at the TRIUMF site. It is a four-sector radial ridge design with two 45-degrees dees in opposite valleys. An external multi-cusp dc ion source generates the beam for axial injection into the cyclotron. Two multiple foil stripping mechanisms produce two simultaneous beams, each of intensities up to 250 μA. First beam was achieved on May 9 1990. The initial acceptance tests were completed on July 20 1990, finishing the project within the 19 month construction schedule. Since then the machine has been used for regular isotope production and operator training. With two target stations in operation a total of 450 μA at 30 MeV has been extracted from the cyclotron, and at 15 MeV 500 μA has been extracted. We will report on the results of beam tests with a higher power RF amplifier, and the simultaneous extraction of two beams of different energies. Emphasis will be on typical operating experience and on the customer acceptance tests. (Author) 5 refs., 3 figs., tab.

28262 (TRI-PP–91-36) **Operational experience with the TRIUMF optically pumped polarized H^- ion source.** Schmor, P.W.; Buchmann, L.; Jayamanna, K.; Levy, C.D.P.; McDonald, M.; Ruegg, R. TRIUMF, Vancouver, BC (Canada). May 1991. 3p.

(CONF-910505–: 1991 Institute of Electrical and Electronics Engineers (IEEE) particle accelerator conference (PAC), San Francisco, CA (United States), 6-11 May 1991). Order Number DE94632530. Source: OSTI; NTIS (US Sales Only); INIS.

The initial goal of a polarized proton beam extracted from the TRIUMF cyclotron, having a current of 5 μA with 60% polarization, has been achieved with the development of the optically pumped polarized H^- ion source. This beam is now being used to produce an intense secondary beam of polarized neutrons for the TRIUMF experimental program. Much of the recent development effort has addressed the reliability requirements for routine operation. This paper describes the results with emphasis on the laser stabilization subsystem, the modifications to the electron cyclotron resonance proton ion source (ECRIS), the sodium charge exchange cells and the development of a low energy polarimeter. Also discussed are the developments which should lead to a higher polarization. (Author) 7 refs.

28263 (TRI-PP–91-37) **Measurements of crowbar performance of the 20 kV 130 A dc power supply of the TRIUMF RF system.** Mitra, A.K. TRIUMF, Vancouver, BC (Canada). May 1991. 2p. (CONF-910505–: 1991 Institute of Electrical and Electronics Engineers (IEEE) particle accelerator conference (PAC), San Francisco, CA (United States), 6-11 May 1991). Order Number DE94632552. Source: OSTI; NTIS (US Sales Only); INIS.

The TRIUMF RF system operates at a fixed frequency of 23.06 MHz with a power capability of 1800 kW. The dc plate power for the four push-pull power amplifiers is provided by a single dc power supply at 20 kV, 130 A and the amplifiers are protected by a single ignitron crowbar circuit. In the case of voltage breakdown outside the tube, the triggering of the crowbar circuit relies on the voltage developed across a low resistance shunt in the return path of the common dc power supply. Frequent failure of the crowbar ignitrons following an external dc voltage breakdown led to the investigation of the crowbar performance. Current transformers have been installed in the common B^+ line to the power amplifiers and the anode circuit of the ignitron crowbar in order to measure amplitude, duration and time delay of various dc currents under fault conditions. Similar current transformers were installed in the individual anode circuits of the power amplifiers to provide protection to the complete system in case of an external dc voltage breakdown. The results of these measurements and recommended solutions for operations are reported. (Author) 3 refs., 4 figs.

28264 (TRI-PP–91-38) **Initial operating experience with the auxiliary accelerating cavity for the TRIUMF cyclotron.** Laxdal, R.E.; Fong, K.; Mackenzie, G.H.; Pacak, V.; Pearson, J.B.; Root, L.; Zach, M. TRIUMF, Vancouver, BC (Canada). May 1991. 3p. (CONF-910505–: 1991 Institute of Electrical and Electronics Engineers (IEEE) particle accelerator conference (PAC), San Francisco, CA (United States), 6-11 May 1991). Order Number DE94632567. Source: OSTI; NTIS (US Sales Only); INIS.

A 92 MHz auxiliary accelerating cavity has been installed in the TRIUMF cyclotron. It operates at the fourth harmonic of the dee frequency with a planned peak voltage of 150 kV. At full power it will almost double the present energy gain per turn in the 400-500 MeV range, reducing by 25% the stripping loss of the H^- beam. Low current beam tests have been conducted at voltages of up to 90 kV and a maximum voltage of 145 kV has been attained. The cavity has also been used to flattop the integrated energy gain per turn. A description of the cavity design and a summary of the operating experience is given. (Author) 6 refs., 6 figs.

28265 (TRI-PP–91-39) **Accelerated radioactive beams at TRIUMF.** D'Auria, J. (Simon Fraser Univ., Burnaby, BC (Canada)); Buchmann, L.; Fraser, J.S.; Schneider, H. TRIUMF, Vancouver, BC (Canada). May 1991. 3p. (CONF-910505–: 1991 Institute of Electrical and Electronics Engineers (IEEE) particle accelerator conference (PAC), San Francisco, CA (United States), 6-11 May 1991). Order Number DE94632531. Source: OSTI; NTIS (US Sales Only); INIS.

An isotope separator (TISOL) has been installed at TRIUMF to study the generation of radioactive beams for use in an accelerated radioactive beams facility (ISAC). As part of this program a single-staged ECR ion source has been designed and connected to the isotope separator. This source is now operational and delivering radioactive ions extracted from the production target. Accelerator studies have shown that a superconducting interdigital structure is an attractive alternative to the room temperature drift-tube linac of the original ISAC proposal. The recently demonstrated high gradients in a RFQ test structure hold promise for the development of a RFQ suitable for the initial stage of ISAC. (Author) 14 refs., 4 figs., tab.

28266 (TRI-PP–91-40) **A 256 channel digital filter for a data acquisition system.** Roberts, W.; Aikens, B. TRIUMF, Vancouver, BC (Canada). May 1991. 3p. (CONF-910505–: 1991 Institute of Electrical and Electronics Engineers (IEEE) particle accelerator conference (PAC), San Francisco, CA (United States), 6-11 May 1991). Order Number DE94632553. Source: OSTI; NTIS (US Sales Only); INIS.

The TRIUMF Central Control System (CCS) employs several data acquisition systems to monitor its operational parameters. Each system multiplexes 256 analog channels into one analog to digital converter. Space constraints on the multiplexer cards prohibit the installation of adequate anti-alias filters which allows 60 Hz and other noise to corrupt the measurements. The new system overcomes this problem by sampling each channel at a 160 samples/second rate and using a DSP microcomputer to lowpass filter the data. The multiplexer and analog-digital converter operate at 256 times the channel sample rate. The channel filter bandwidth is restricted to approximately 1 Hz due to the rate at which the CCS reads the data. One DSP microcomputer is able to filter the 256 channels in a multiplexed system at a cost less than that of the anti-alias filters which would otherwise have been required. (Author) 4 refs., 3 figs.

28267 (TRI-PP–91-42) **Collimator simulation for the TRIUMF KAON factory using DIMAD.** Wienands, U. (TRIUMF, Vancouver, BC (Canada)); Jones, F.W.; Parfitt, C.P TRIUMF, Vancouver, BC (Canada). May 1991. 3p. (CONF-910505–: 1991 Institute of Electrical and Electronics Engineers (IEEE) particle accelerator conference (PAC), San Francisco, CA (United States), 6-11 May 1991). Order Number DE94632554. Source: OSTI; NTIS (US Sales Only); INIS.

A collimator-element routine has been developed for the lattice and tracking code DIMAD to facilitate simulation of the beam collimation system for the TRIUMF KAON Factory accelerators. Multiple Coulomb scattering, energy loss, and elastic nuclear scattering are simulated, and the fraction of particles undergoing inelastic nuclear events is estimated. The routines are accurate over a large energy range, up to about 1 TeV. Results for the beam collimation system of the KAON Factory Booster synchrotron are presented. (Author) 6 refs., 5 figs.

28268 (WSRC-MS–94-0383) **Materials considerations in accelerator targets.** Peacock, H.B. Jr. (Westinghouse Savannah River Co., Aiken, SC (United States). Materials Technology Section); Iyer, N.C.; Louthan, M.R. Jr. Westinghouse Savannah River Co., Aiken, SC (United States). [1994]. 12p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035. (CONF-9407103–2: International conference on accelerated-driven transmutation technologies and applications, Las Vegas, NV (United States), 25-28 Jul 1994). Order Number DE94015832. Source: OSTI; NTIS; INIS; GPO Dep.

Future nuclear materials production and/or the burn-up of long lived radioisotopes may be accomplished through the capture of spallation produced neutrons in accelerators. Aluminum clad-lead and/or lead alloys has been proposed as a spallation target. Aluminum was the cladding choice because of the low neutron absorption cross section, fast radioactivity decay, high thermal conductivity, and excellent fabricability. Metallic lead and lead oxide powders were considered for the target core with the fabrication options being casting or powder metallurgy (PM). Scoping tests to evaluate gravity casting, squeeze casting, and casting and swaging processes showed that, based on fabricability and heat transfer considerations, squeeze casting was the preferred option for manufacture of targets with initial core cladding contact. Thousands of aluminum clad aluminum-lithium alloy core targets and control rods for tritium production have been fabricated by coextrusion processes and successfully irradiated in the SRS reactors. Tritium retention in, and release from the coextruded product was modeled

from experimental and operational data. Newly produced tritium atoms were trapped by lithium atoms to form a lithium tritide. The effective tritium pressure required for trap or tritide stability was the equilibrium decomposition pressure of tritium over a lithium tritide-aluminum mixture. The temperature dependence of tritium release was determined by the permeability of the cladding to tritium and the local equilibrium at the trap sites. The model can be used to calculate tritium release from aluminum clad, aluminum-lithium alloy targets during postulated accelerator operational and accident conditions. This paper describes the manufacturing technologies evaluated and presents the model for tritium retention in aluminum clad, aluminum-lithium alloy tritium production targets.

4304 Storage Rings

Refer also to citation(s) 28232

28269 (ANL/APS/CP–83263) **Field configuration of beam excited modes in the Advanced Photon Source (APS) storage ring waveguides.** Brauer, S.O. (Argonne National Lab., IL (United States). Advanced Photon Source); Kustom, R.L.; Uslenghi, P.L.E. Argonne National Lab., IL (United States). Advanced Photon Source Accelerator Systems Div. [1994]. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-940531–2: International symposium on electromagnetic environments and consequences, Bordeaux (France), 30 May - 3 jun 1994). Order Number DE94015096. Source: OSTI; NTIS; INIS; GPO Dep.

Argonne National Laboratory (ANL) is in the process of building a positron accelerator and storage ring, the Advanced Photo source (APS). The RF system for the APS storage ring uses 16 cylindrical TM010-like, reentrant cavities operating at 351.93 MHz to resupply energy lost by the beam due to synchrotron radiation. The stored beam will have approximately 60 bunches, 5 mA per bunch, for a total beam current of 300 mA. Calculations of the threshold current for coupled-bench instabilities in the storage ring have indicated that several beam-induced higher-order modes (HOMs) will reduce the threshold for beam stability and therefore should be damped. Previous data taken using a pillbox cavity showed that it is likely that some of these modes couple, through the coupling loop, from the storage ring cavity into the waveguide. This study investigates the electric and magnetic field configuration of each HOM present in the waveguide. A pillbox and a prototype storage ring cavity, together with various WR2300 waveguide components, are used to obtain the measurements needed for the determination of the mode configuration of the HOMs at the frequencies of interest. To avoid the development of beam instabilities due to the existence of these HOMs in the rf cavity, damping of the modes will be required. The HOMs present in the rf cavity coupling into the loop coupler and traveling through the coupler into the waveguide, may allow damping of some of the HOMs by insertion of dampers into the waveguide adjacent to each cavity.

28270 (ANL/ASD/CP–81725) **Proposed time-resolved photon-imaging diagnostics for the APS.** Lumpkin, A.H.; Sellyey, W.; Yang, B. Argonne National Lab., IL (United States). [1994]. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-940618–26: 4. European particle accelerator conference, London (United Kingdom), 27 Jun - 1 jul 1994). Order Number DE94016301. Source: OSTI; NTIS; INIS; GPO Dep.

Plans for time-resolving the synchrotron radiation emitted by circulating particle beams and characterizing parameters of those beams for the three rings in the Advanced Photon Source (APS) are briefly presented. The APS includes a 450-MeV positron accumulator ring (PAR), a 0.45-to-7-GeV injector synchrotron (IS), and the 7-GeV storage ring. Both imaging and photon area detector principles are used for time-resolved information. Gated, intensified cameras and synchroscan and dual-sweep streak cameras will be used to assess single bunch, bunch-to-bunch, or turn-to-turn phenomena. Both the transverse and longitudinal phase space effects can be tracked. An example of the transverse damping in the PAR at 250 MeV and initial tests in the lab of the dual-sweep streak camera will be presented.

28271 (ANL/ASD/CP–81727) **Closed orbit feedback with digital signal processing.** Chung, Y. (and others); Kirchman, J.; Lenkszus, F. Argonne National Lab., IL (United States). [1994]. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-940618–25: 4. European particle accelerator conference, London (United Kingdom), 27 Jun - 1 jul 1994). Order Number DE94016306. Source: OSTI; NTIS; INIS; GPO Dep.

The closed orbit feedback experiment conducted on the SPEAR using the singular value decomposition (SVD) technique and digital signal processing (DSP) is presented. The beam response matrix, defined as beam motion at beam position monitor (BPM) locations per unit kick by corrector magnets, was measured and then analyzed using SVD. Ten BPMs, sixteen correctors, and the eight largest SVD eigenvalues were used for closed orbit correction. The maximum sampling frequency for the closed loop feedback was measured at 37 Hz. Using the proportional and integral (PI) control algorithm with the gains $K_p = 3$ and $K_I = 0.05$ and the open-loop bandwidth corresponding to 1% of the sampling frequency, a correction bandwidth (−3 dB) of approximately 0.8 Hz was achieved. Time domain measurements showed that the response time of the closed loop feedback system for 1/e decay was approximately 0.25 second. This result implies ~ 100 Hz correction bandwidth for the planned beam position feedback system for the Advanced Photon Source storage ring with the projected 4-kHz sampling frequency.

28272 (ANL/ASD/CP–83387) **A new accelerator alignment concept using laser trackers.** Friedsam, H. Argonne National Lab., IL (United States). [1994]. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-940618–14: 4. European particle accelerator conference, London (United Kingdom), 27 Jun - 1 jul 1994). Order Number DE94015088. Source: OSTI; NTIS; INIS; GPO Dep.

This paper outlines the basic principle of the laser tracker and the new and simplified alignment concept for the APS based on the use of these laser trackers. These instruments not only provide the necessary accuracy for positioning of beam components but are also reducing the time and manpower requirements for the alignment of beam elements. The presented alignment concept will be especially valuable when considering the alignment of small scale accelerators.

28273 (ANL/ASD/CP–83408) **Design and performance of a 2-megawatt high voltage dc test load.** Horan, D.; Kustom, R.; Ferguson, M. Argonne National Lab., IL (United States). [1994]. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-940618–13: 4. European particle accelerator conference, London (United Kingdom), 27 Jun - 1 jul 1994). Order Number DE94015023. Source: OSTI; NTIS; INIS; GPO Dep.

A high-power water-cooled resistive load which simulates the electrical load characteristics of a high-power klystron, capable of a 2 MW dissipation at 95 kV DC, is designed and installed. The load utilizes wirewound resistor elements suspended inside G-11 insulated tubing contained within a single-wall 316 stainless steel pressure vessel with flanged elliptical heads. The vessel supplies a continuous flow of deionized water. Baffles fabricated from G-10 sheets support the tubing and promote water turbulence to maximize heat removal. A companion oil tank houses resistive filament and mod-anode power supply test loads, plus an electrical interlock system which provides protection from inadequate water flow, excessive oil temperature, and arcing in either the pressure vessel or oil tank. A secondary safety system consists of both hydrostatic and steam pressure relief valves on the pressure vessel. Power supply tests indicate the load simulates the electrical load characteristics of a high-power klystron to a degree sufficient to accurately performance-test the rf high voltage power supplies used at the Advanced Photon Source.

28274 (ANL/ASD/CP–83409) **A new method to position the APS dipoles with the use of a laser tracker.** Friedsam, H.; Penicka, J. Argonne National Lab., IL (United States). [1994]. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-940618–17: 4. European particle accelerator conference, London (United Kingdom), 27 Jun - 1

jul 1994). Order Number DE94015079. Source: OSTI; NTIS; INIS; GPO Dep.

The alignment requirements for the synchrotron light sources have increased to the limit of today's alignment techniques. Some components such as dipoles can only be positioned after having obtained a three-dimensional outline of the as-built magnet. The laser tracking system provides the unique opportunity to map the dipole gap and relate the information to the outside reference marks for the placement of the magnet. In this case the Leica SMART 310 laser tracker is used as a 3D coordinate measuring system that provides the necessary information of twist, roll, sag, and gap changes over the full dipole length. On the basis of this information the best fitting plane is calculated to obtain the average roll angle for the positioning of the dipole. This paper describes the basic principal of this alignment technique and demonstrates the achieved results with examples.

28275 (BNL–49504) **Shimming techniques for the ultraprecise muon g-2 storage ring at the AGS.** Danby, G.T.; Jackson, J.W. Brookhaven National Lab., Upton, NY (United States). [1993]. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH00016. (CONF-930926–39: 13. international conference on magnet technology, Victoria (Canada), 20-24 Sep 1993). Order Number DE94015147. Source: OSTI; NTIS; INIS; GPO Dep.

Major components are in an advanced state of construction for a 7 meter radius 0.1 PPM precision storage ring. Detailed techniques are planned for static shimming of the assembly to at least 10 PPM magnetic field uniformity prior to the use of field correction coils. An air gap behind each ultra-pure iron pole piece strongly decouples the aperture field shape from the properties of the 1,006 iron yoke. Iron wedges whose thickness varies across the width of the poles with slope of $\sim$ 1/60 are used to eliminate the gradient produced by the C-magnet shape required for open access for the decay electron counter on the inside radius of the storage ring magnet. These wedges are 10 cm in azimuthal length and can be radially adjusted for short wavelength field adjustments. A horizontal motion of 50 μm effectively adjusts the 10 cm half-gap aperture by 1 μm (or 10 PPM). This and other techniques to adjust dipole, quadrupole, sextuple, etc. multipoles will be described.

28276 (BNL–60555) **Design parameters for gas-cooled electrical leads of the g-2 magnets.** Jia, L.X. (Brookhaven National Lab., Upton, NY (United States)); Addessi, L.J.; Cullen, J.R. Jr.; Esper, A.J.; Meier, R.E.; Pai, C.; Snydstrup, L.P.; Green, M.A. Brookhaven National Lab., Upton, NY (United States). [1994]. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH00016. (CONF-940615–1: 15. international cryogenic engineering conference, Genoa (Italy), 7-10 Jun 1994). Order Number DE94014878. Source: OSTI; NTIS; INIS; GPO Dep.

This report presents the design parameters for a pair of 5300 A gas-cooled electrical leads for the g-2 solenoids and a pair of 2850 A leads for the inflector magnet. The lead design parameters are derived from a scale analysis of two one-dimensional, thermo-fluid-electro-quasi-coupled, and non-linear differential equations. The analysis may apply to general gas-cooled electrical lead design. As an illustration, these design parameters are applied to multi-tube gas-cooled leads that are proposed for the g-2 solenoid magnet system. Multiple electrical current carrying tubes and multiple gas flow cooling channels will increase the lead current capacity and lead efficiency for enhanced heat transfer and low flow pressure drop.

28277 (BUDKERINP–93-90) **The impedance of a toroidal chamber with walls of finite conductivity. Waveguide model.** Karliner, M.M.; Mityanina, N.V.; Yakovlev, V.P. AN SSSR, Novosibirsk (Russian Federation). Inst. Yadernoj Fiziki. 1993. 68p. (IYaF–93-90.). Order Number DE94632571. Source: OSTI; NTIS (US Sales Only); INIS.

Using the waveguide model, the longitudinal coupling impedance in a toroidal chamber with walls of finite conductivity is studied. 6 refs.

28278 (IYaF–93-27) **Chromatin compensation and dynamic aperture of the Sibir'-2 electron storage ring (numerical simulation).** Korchuganov, V.N.; Levichev, E.B.; Sazhaev, V.V. AN SSSR, Novosibirsk (Russian Federation). Inst. Yadernoj Fiziki. 1993. 35p. (In Russian). Order Number DE94632572. Source: OSTI; NTIS (US Sales Only); INIS.

Effect of regular qudratic nonlinear fields (sextupole lenses) intended for compensation of linear chromatism nonlinear errors of magnet fields and quadrupole lenses with an account of particle nonequilibrium pulse on the particle dynamics in the Sibir' storage ring was stided by numerical simulation method. 16 refs.

28279 (IYaF–93-78) **Electron gun with controlled current Rig testing and first experiments at LEAR.** Lapik, R.M. (and others); Meshkov, I.N.; Polyakov, V.N. AN SSSR, Novosibirsk (Russian Federation). Inst. Yadernoj Fiziki. 1993. 36p. (In Russian). Order Number DE94632573. Source: OSTI; NTIS (US Sales Only); INIS.

The first experiments on cooling the new electron gun are performed for the proton beam with pulses of 300 MeV/s, 200 MeV/s and 100 MeV/s. The electron and proton beams parameters are presented. 14 refs.

28280 (IYaF–93-79) **Faraday cup type collection with transport electrode.** Meshkov, I.N. (and others); Polyakov, V.N.; Smirnov, A.V. AN SSSR, Novosibirsk (Russian Federation). Inst. Yadernoj Fiziki. 1993. 12p. (In Russian). Order Number DE94632574. Source: OSTI; NTIS (US Sales Only); INIS.

Results on testing the Faraday cup-type colelctor with transport electrode for its application for electron beam recuperation are presented. 5 refs.

28281 (JINR-E–9-92-259) **JINR tau-charm factory study.** Perel'shtejn, Eh.A. (and others); Aleksandrov, V.S.; Antropov, V.K. Joint Inst. for Nuclear Research, Dubna (Russian Federation). Lab. of Nuclear Problems. 1992. 12p. Order Number DE94632575. Source: OSTI; NTIS (US Sales Only); INIS.

Submitted to 15 Intern. Conf. on High Energy Accelerators, Hamburg, Germany, July 20-24, 1992.

The tau-charm factory is a part of designed JINR storage-ring complex. The further study of an injection complex and main ring were performed to reach the high level average luminosity. The questions of the beam dynamics, magnetic lattice designing, low background problem, etc. are examined. The second variant of the main ring has an only interaction point. The more detailed analysis of variaous systems is given. The proposal of a hybrid scheme for realization both flat beam and monochromatization scheme variants in only machine is considered. 6 refs.; 8 figs.; 2 tabs.

28282 (KEK-PROC–93-7, pp. 159-166) **Klystron equalization for RF feedback.** Corredoura, P. (Stanford Linear Accelerator Center, CA (United States)). National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan). Jun 1993. (CONF-9211172–: International workshop on B factories: accelerators and experiments, Tsukuba (Japan), 17-20 Nov 1992). In *Proceedings of international workshop on B-factories: accelerators and experiments (BFWS92)*. 435p. Order Number DE94737962. Source: OSTI; NTIS; INIS.

The next generation of colliding beam storage rings support higher luminosities by significantly increasing the number of bunches and decreasing the spacing between respective bunches. The heavy beam loading requires large RF cavity detuning which drives several lower coupled bunch modes very strongly. One technique which has proven to be very successful in reducing the coupled bunch mode driving impedance is RF feedback around the klystron-cavity combination. The gain and bandwidth of the feedback loop is limited by the group delay around the feedback loop. Existing klystrons on the world market have not been optimized for this application and contribute a large portion of the total loop group delay. This paper describes a technique to reduce klystron group delay by adding an equalizing filter to the klystron RF drive. Such a filter was built and tested on a 500 kW klystron as part of the on going PEP-II R and D effort here at SLAC. (author).

28283 (KEK-PROC–93-7, pp. 211-215) **Measurement of seismic motion and displacement of the floor at the TRISTAN ring, and the alignment issues.** Sugahara, R. (National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan)); Endo, K.; Kuroda, S.; Mimashi, T.; Ohsawa, Y. National Lab. for High Energy Physics,

Tsukuba, Ibaraki (Japan). Jun 1993. (CONF-9211172–: International workshop on B factories: accelerators and experiments, Tsukuba (Japan), 17-20 Nov 1992). In *Proceedings of international workshop on B-factories: accelerators and experiments (BFWS92).* 435p. Order Number DE94737962. Source: OSTI; NTIS; INIS.

The seismic motion and the variation of the displacement of the floor at the TRISTAN ring was measured in the Tsukuba region. Results are presented. And the stretched wire technique is being developed as a precision alignment method. Present sensitivity and resolution, limited by the electronics noise, are about 2.8 V/μm and 0.1 μm respectively. (author).

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4401 Radiation Instrumentation

Refer also to citation(s) 27298, 27536, 27537, 28049, 28140, 28158, 28238, 28243, 28342, 28532, 28548, 28595, 28596, 28604, 28675, 28718, 28723, 28732, 28941

28284 (ANL-HEP-TR–94-28) **Engineering design evaluation of Atlas tile-calorimeter.** Hill, N.; Guarino, V.; Proudfoot, J.; Stanek, R.; Price, L.; Petereit, E. Argonne National Lab., IL (United States). [1994]. 23p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-9404191–1: Atlas week conference, Geneva (Switzerland), 18-22 Apr 1994). Order Number DE94015073. Source: OSTI; NTIS; INIS; GPO Dep.

In an effort to familiarize themselves with the work that has been done to date on the design of the Tile Cal hadron calorimeter for Atlas, the authors have undertaken a thorough examination of the current designs. They concentrated on the work that has been done by the IHEP Group at Protvino, and in particular the work presented at the last Atlas Week. They constructed six different finite element models as they have learned more about the system. These models were meant to be rough models only and do not represent actual construction in all cases. In some cases, shortcuts were taken in an attempt to set boundary conditions and to reduce the size of the problem to accommodate software limitations, while still providing enough information to further the understanding of the design. After reviewing the analysis and thinking about the construction, the authors have some suggested modifications, which are presented in this paper. It is clear that the work done at both CERN and Protvino has been impressive and thorough. The authors have tried to evaluate and understand both the CERN baseline design and the suggested design option from Protvino.

28285 (ANL/PHY/CP–83448) **Electronics for the Si detectors in APEX.** Wilt, P.R. (Argonne National Lab., IL (United States)); Betts, R.R.; Freer, M. Argonne National Lab., IL (United States); Lawrence Berkeley Lab., CA (United States). [1994]. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38 ; AC03-76SF00098. (CONF-9405199–1: LeCroy conference on electronics for future colliders, Montvale, NJ (United States), 10-11 May 1994). Order Number DE94015078. Source: OSTI; NTIS; INIS; GPO Dep.

APEX (ATLAS Positron EXperiment), a collaborative effort of ANL, FSU, MSU/NSCL, Princeton, Queen's, Rochester, Washington and Yale, is an experiment to study positron and electron production in very heavy ion collisions. The electrons and positrons are detected with two detector arrays, each consisting of 216 1 mm thick Si PIN diodes, and their energy and time-of-flight are measured. The number of detectors and limited space made it necessary to develop a system that could efficiently process and transfer signals from the detectors to the charge sensing ADC's and data readout electronics as well as monitor the condition of the detectors. The discussion will cover the electronics designed for the Si detectors, including the charge amplifier, "Mother board" for the charge amplifiers, 8 channel Shaper, 16 channel Constant Fraction Discriminator (CFD), 16 channel Peak-to-FERA (PTF) and the integration of the CFD and PTF with Charge sensing ADC's. Function and performance of the individual modules as well as the system as a whole will be discussed.

28286 (BNL–52423) **The linearity performance of a two-dimensional, x-ray proportional chamber with 0.5mm anode wire spacing.** Smith, G.C.; Yu, B. Brookhaven National Lab., Upton, NY (United States). Apr 1994. 3p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH00016. (CONF-941061–2: Nuclear science symposium: medical imaging conference, Norfolk, VA (United States), 30 Oct - 5 nov 1994). Order Number DE94013360. Source: OSTI; NTIS; GPO Dep.

A method of construction of multiwire chambers has been developed which yields X-ray images with very small non-linearity due to anode wire modulation. The technique requires an absorption region in the detector, with the anode and upper cathode wires, which are parallel to one another, in registration with each other. Studies show that the strength of the electric field in the drift region determines the degree of anode wire modulation and, under specific conditions, modulation is havled in periodicity and significantly reduced in amplitude. New interpolating cathodes have been developed to readout position in the other axis, along the anode wire direction. Position resolution in both axes between 100–150 micron FWHM has been achieved. Two-dimensional images of small objects have been taken which show unprecedented linearity.

28287 (BNL–60294) **Study of the long term stability of the effective concentration of ionized space charges (N_{eff}) of neutron irradiated silicon detectors fabricated by various thermal oxidations.** Li, Z. (Brookhaven National Lab., Upton, NY (United States)); Chen, W.; Kraner, H.W.; Eremin, V.; Lindstroem, G.; Spiriti, E. Brookhaven National Lab., Upton, NY (United States). Mar 1994. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH00016. (CONF-941061–4: Nuclear science symposium: medical imaging conference, Norfolk, VA (United States), 30 Oct - 5 nov 1994). Order Number DE94013734. Source: OSTI; NTIS; INIS; GPO Dep.

Experimental study of the reverse annealing of the effective concentration of ionized space charges (N_{eff}, also called effective doping or impurity concentration) of neutron irradiated high resistivity silicon detectors fabricated on wafers with various thermal oxides has been conducted at room temperature (RT) and elevated temperature (ET). Various thermal oxidations with temperatures ranging from 975°C to 1200°C with and without trichlorethane (TCA), which result in different concentrations of oxygen and carbon impurities, have been used. It has been found that, the RT annealing of the N_{eff} is hindered initially ($t < 42$ days after the radiation) for detectors made on the oxide with high carbon concentration, and there was no carbon effect on the long term ($t >$ 42 days after the radiation) N_{eff} reverse annealing. No apparent effect of oxygen on the N_{eff} stability has been observed at RT. At elevated temperature (80°C), no significant difference in annealing behavior has been found for detectors fabricated on silicon wafers with various thermal oxides. It is apparent that for the initial stages (first and or second) of N_{eff} reverse annealing, there may be no dependence on the oxygen and carbon concentrations.

28288 (BONN-IR–93-55) **Development of a model-independent evaluation of photon-deuteron reactions for the SAPHIR detector.** Wolf, A. Bonn Univ. (Germany). Physikalisches Inst.; Bonn Univ. (Germany). Mathematisch-Naturwissenschaftliche Fakultaet. 20 Oct 1993. 80p. (In German). Order Number DE94786359. Source: OSTI; NTIS (US Sales Only); INIS.

The SAPHIR detector measures photon induced reactions with many particles in the final state. Thus a detailed investigation of those processes at photon energies between 0.4 and 3.3 GeV is possible. The interpretation of the distribution of the sample of events, which SAPHIR is able to reconstruct, has to be done after a correction of influences induced by the detector acceptance. In this work a model independent method of correcting and analysing the data is discussed. The implementation of the basic tools of this analysis is described and first tests with simulated and real events are performed. SAPHIR uses a time-of-flight system for the identification of particles. This work describes the structure of a program library, which supports an easy way of decoding the digitizations of this system (including calibration of the hardware) and obtaining the flight time for a particle in a event. The necessary step for calibrating the system are outlined, too. (orig.)

28289 (BUDKERINP–93-59) **Influence of the bulk resistivity of class with electronic conductivity on the performance of microstrip gas chamber.** Pestov, Yu.N.; Shekhtman, L.I. AN SSSR, Novosibirsk (Russian Federation). Inst. Yadernoj Fiziki. 1993. 17p. (IYaF–93-59.). Order Number DE94632786. Source: OSTI; NTIS (US Sales Only); INIS.

The optimization of parameters of Microstrip Gas Chambers (MSCGC) on glass substrata with electronic conductivity is presented. 16 refs.

28290 (CEA-CONF–11680) **Applicability of a global spectral analysis method in X-ray and low energy gamma ray detection for ^{239}Pu whole-body counting measurement.** Razafindralambo, N. (CEA Centre d'Etudes de Fontenay-aux-Roses, 92 (France). Inst. de Protection et de Surete Nucleaire); Franck, D.; Pihet, P.; Morel, J. CEA Centre d'Etudes de Fontenay-aux-Roses, 92 (France). Inst. de Protection et de Surete Nucleaire. 1993. 5p. (In French). (CONF-9310279–: Three days on gamma and x-rays spectrometry, Saint-Remy-les-Chevreuse (France), 12-14 Oct 1993). Order Number DE94632775. Source: OSTI; NTIS (US Sales Only); INIS.

In vivo detection of ^{239}Pu within the lung relies on measuring the LX rays which accompany most transuranic radioactive decays. Current limits of detectors for the measurement of lung intake of ^{239}Pu remain high compared with the annual limit of intake. This work was aimed at characterizing the response of a HPGe detector to ^{239}Pu LX rays in different conditions approaching lung monitoring. The measurements were performed using different geometric sources combined with different absorbers and using a realistic chest phantom. The results were analyzed in terms of detection limit with the emphasis on the influence of X ray absorption in the lung and the overlying tissues, or muscle-equivalent thicknesses. The analysis of mixed ^{239}Pu/^{241}Am spectra were investigated using a deconvolution method based on spectra measured in the same geometric conditions for each radioelement. The applicability of this method was assessed with regard to different parameters as activity level, absorption and region of interest. The advantage of using such an analysis method for the interpretation of the mixed spectra is discussed with regard to detection limit and the application of X ray spectrometry in whole body counting. (authors). 2 figs., 4 tabs., 8 refs.

28291 (CENBG–9115) **The EUROGAM project: status and developments.** Aleonard, M.M. Bordeaux-1 Univ., 33 - Gradignan (France). Centre d'Etudes Nucleaires. [1991]. 12p. (CONF-9103176–: Workshop on future directions in nuclear physics with 4π gamma detection systems of the new generation, Strasbourg (France), 4-16 Mar 1991). Order Number DE94632791. Source: OSTI; NTIS (US Sales Only); INIS.

The features of the EUROGAM multidetector array, composed of 45 Ge with their associated anti-Compton shield are presented. The properties of the detectors and an upgrade of the geometry are described. The data acquisition system incorporates integrated electronic designed with the new VXI standard; the whole system is distributed on a network and takes benefit of UNIX based workstations and the real time facilities of VxWorks. (author). 3 refs., 7 figs., 1 tab.

28292 (CENBG–9116) **Ultra low radioactivity measurements in the Frejus Underground Laboratory.** Dassie, D. (Bordeaux-1 Univ., 33 - Gradignan (France). Centre d'Etudes Nucleaires); Huhert, F.; Hubert, Ph.; Isaac, M.C.; Izac, C.; Leccia, F.; Mennrath, P.; Busto, J.; Jullian, S. Bordeaux-1 Univ., 33 - Gradignan (France). Centre d'Etudes Nucleaires. [1991]. 15p. (CONF-9109182–: 2. international workshop on theoretical and phenomenological aspects of underground physics, Toledo (Spain), 9-13 Sep 1991). Order Number DE94632787. Source: OSTI; NTIS (US Sales Only); INIS.

Using the performances of the low background Ge spectrometer, a long term program of low activity material selection and control is being carried out in the Frejus Underground Laboratory. The low background Ge detector and the measurement procedure is described. Gamma-activities are measured with sensitivity down to 0.1 dpm/kg. Applications involve physics and astrophysics research, ocean and environmental sciences and industrial developments. (R.P.) 3 refs., 3 figs., 1 tab.

28293 (CONF-9303122–, pp. 23-30) **Long-pathlength infrared absorption measurements of line and continuum features in the 8- to 14-μm atmospheric window.** Kulp, T.J. (Lawrence Livermore National Laboratory, CA (United States)); Shin, J. USDOE Office of Energy Research, Washington, DC (United States). Mar 1994. From 3. Atmospheric Radiation Measurement (ARM) science team meeting; Norman, OK (United States); 1-5 Mar 1993. In *Proceedings of the third Atmospheric Radiation Measurement (ARM) science team meeting.* 379p. Source: OSTI; NTIS; INIS.

To characterize latent infrared (IR) absorption in the 8- to 14 μm atmospheric window, long-pathlength absorption measurements using a Fourier transform infrared spectrometer (FTIR) are being made. Measurements are being made on gas samples contained in a 400-m maximum pathlength Horn Pimentel multipass cell that was designed constructed for the project. Immediate aims are to fill in gaps in the experimental radiative transfer databases pertaining to the line parameters and to the self- and foreign-broadened water vapor continuum. There are many lines which have not been measured in the laboratory and many conditions of atmospheric importance under which the continuum absorption has not been determined. This paper reports the progress in these areas.

28294 (DESY–93-199) **Scintillating fiber target detectors for future generation neutrino experiments.** Nahnhauer, R. Deutsches Elektronen-Synchrotron (DESY), Zeuthen (Germany). Inst. fuer Hochenergiephysik. Dec 1993. 8p. (CONF-9310261–: SCIFI 93: workshop on scintillating fiber detectors, South Bend, IN (United States), 24-28 Oct 1993). Order Number DE94790017. Source: OSTI; NTIS (US Sales Only); INIS.

A modular neutrino detector based on scintillating fibers is described. The readout system consists of an image intensifier chain connected with a CCD. An image of a 5 GeV/c π^- crossing a hexagonal capillary bundle of this detector is presented. (HSI)

28295 (DESY–93-200) **High precision particle tracking with a fiber detector at the HERA ep-collider.** Baehr, J.; Hiller, K.; Hoffmann, B.; Luedecke, H.; Menchikov, A.; Nahnhauer, R.; Pohl, M.; Roloff, H.E.; Voelkert, R. Deutsches Elektronen-Synchrotron (DESY), Zeuthen (Germany). Inst. fuer Hochenergiephysik. Dec 1993. 14p. (CONF-9310261–: SCIFI 93: workshop on scintillating fiber detectors, South Bend, IN (United States), 24-28 Oct 1993). Order Number DE94790016. Source: OSTI; NTIS (US Sales Only); INIS.

A scintillating fiber detector is described, which shall be applied in a forward proton spectrometer supplementing the H1 detector. This detector has been tested with cosmic rays, and an average point resolution of 63μm is obtained together with an average efficiency per double layer of 93%. (HSI)

28296 (DESY–94-048) **Further development of the ZEUS Expert System: Computer science foundations of design.** Flasinski, M. Deutsches Elektronen-Synchrotron (DESY), Hamburg (Germany). Mar 1994. 30p. Order Number DE94789665. Source: OSTI; NTIS (US Sales Only); INIS.

The prototype version of the ZEUS Expert System, ZEXP, was diagnosing selected aspects of DAQ System during ZEUS running in 1993. In November 1993 ZEUS decided to extend its scope in order to cover all crucial aspects of operating the ZEUS detector (Run Control, Slow Control, Data Acquisition performance and Data Quality Monitoring). The paper summarizes fundamental assumptions concerning the design of the final version of the ZEUS Expert System, ZEX. Although the theoretical background material relates primarily to ZEX, its elements can be used for constructing other expert systems for HEP experiments. (orig.)

28297 (DOE/FTR–94009527) **US Japanese collaboration on the development of superconducting solenoids for detector magnets: Foreign trip report, February 6–18, 1994.** Kephart, R.; Stanek, R. Fermi National Accelerator Lab., Batavia, IL (United States). [1994]. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH03000. Order Number DE94009527. Source: OSTI; NTIS (US Sales Only); GPO Dep.

Purpose of this trip was to continue the US Japanese collaboration on the development of superconducting solenoids for detector magnets. This effort was part of the SDC detector R&D program

for the now canceled SSC project. A large prototype superconducting magnet (3.4 M in diameter and 2 M in length) was designed by a Fermilab-KEK collaboration to test concepts to be used in the SDC magnet. This prototype was built at Toshiba corporation. The cryostat outer vacuum vessel was designed at Fermilab and was built in the US Aerospace industry using ISOGRID techniques. It was shipped to Japan where it was integrated into the prototype package last summer. The prototype was shipped to KEK in late 1993. The purpose of this trip was to participate in the first excitation tests of the prototype to full current. These tests and subsequent publication of the results represent the close-out of this SSC related activity.

28298 (EGG–1183-2349) **Crystal growth and evaluation of mercuric iodide nuclear detectors, November 15, 1975–June 30, 1976.** Schieber, M. EG and G, Inc., Las Vegas, NV (United States). Oct 1976. 52p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC08-76NV01183. Order Number DE94015831. Source: OSTI; NTIS; GPO Dep.

A research effort on mercuric iodide (HgI_2) was initiated in November 1974 at the Hebrew University of Jerusalem to complement the crystal growth of HgI_2 now being studied as part of the SANDS Program at EG&G, Inc. at Santa Barbara, California. The program was supposed to carry on some crystal growth experiments in a horizontal furnace which, although was considered promising, had to be abandoned at EG&G, where the experiments concentrated on crystal growth in a vertical furnace. In addition, it was expected that certain crystal quality characterization and evaluation methods – interesting and not available at EG&G – would also be studied. This report describes the various experiments performed in Jerusalem. In terms of crystal purification, because the Jerusalem group has used three times more sublimation cycles, resulting in better nuclear spectroscopic performance, it had induced the EG&G group to increase its number of purification cycles, resulting in better quality crystals. In terms of crystal growth, the horizontal furnace method was perfected and has allowed the growth of large (~50 g) good quality crystals. At the request of the ERDA-NVO patent office, a patent application has been filed to describe the HgI_2 crystal growth in a horizontal furnace. The following crystal evaluation studies have also been performed: (1) Scanning electron microscopy; (2) x-ray luminescence; (3) thermal stimulated conductivity (TSC) studies; (4) measuring the dc fluence x-ray irradiation; and (5) gamma nuclear spectral response of the grown crystals.

28299 (FNAL/C–94/140) **Gaseous detectors of ultraviolet and visible photons.** Peskov, V. (Fermi National Accelerator Lab., Batavia, IL (United States)); Borovik-Romanov, A.; Volynshikova, T. Fermi National Accelerator Lab., Batavia, IL (United States). Jun 1994. 15p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH03000. (CONF-940524–12: 8. symposium on radiation measurements and applications, Ann Arbor, MI (United States), 16-19 May 1994). Order Number DE94014990. Source: OSTI; NTIS; INIS; GPO Dep.

We describe simple methods of manufacturing in a laboratory gaseous detectors of visible photons with GaAs(Cs) and SbCs photocathodes and Ti getters. Covered by CsI protective layers they are robust enough to be stable under ordinary experimental conditions. First attempts to use these detectors for crystal scintillator and fiber readout are presented.

28300 (FNAL/C–94/183) **Scintillating fiber detector performance, detector geometries, trigger, and electronics issues for scintillating fiber tracking.** Baumbaugh, A.E. Fermi National Accelerator Lab., Batavia, IL (United States). Jun 1994. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH03000. (CONF-9405168–4: 6. Pisa meeting on advanced detectors, Elba (Italy), 22-28 May 1994). Order Number DE94015525. Source: OSTI; NTIS; INIS; GPO Dep.

Scintillating Fiber tracking technology has made great advances and has demonstrated great potential for high speed charged particle tracking and triggering. The small detector sizes and fast scintillation fluors available make them very promising for use at high luminosity experiments at today's and tomorrow's colliding and fixed target experiments where high rate capability is essential. This talk will discuss the current state of Scintillating fiber performance and current Visual Light Photon Counter (VLPC) characteristics. The primary topic will be some of the system design and integration issues which should be considered by anyone attempting to design a scintillating fiber tracking system which includes a high speed tracking trigger. Design. constraints placed upon the detector system by the electronics and mechanical subsystems will be discussed. Seemingly simple and unrelated decisions can have far reaching effects on overall system performance. SDC and DO example system designs will be discussed.

28301 (FNAL-TM–1892) **A beginners guide to the SVXII.** Yarema, R.; Kipnis, I.; Kleinfelder, S.; Luo, L.; Milgrome, O.; Sarraj, M.; Yarema, R.; Zimmerman, T. Fermi National Accelerator Lab., Batavia, IL (United States). Jun 1994. 32p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH03000. Order Number DE94015843. Source: OSTI; NTIS; INIS; GPO Dep.

In the late 1980's, several versions of a full custom chip called the SVX were built and tested. The chip was designed to be a second generation silicon strip readout chip incorporating new features such as data sparsification for silicon strip detectors. The SVX designed by Stuart Kleinfelder and others at LBL contained 128 channels of electronics and proved to be very popular. Initially the chip was fabricated in 3.0 micron process and later transferred to a 1.2 micron radiation hard process. Based on the success of the first SVX (referred herein as SVXI), a need arose for a third generation device. This new 128 channel device called the SVXII was developed by a collaboration of engineers at Fermilab and Lawrence Berkeley Laboratory. The SVXII, designed in a 1.2 micron process, contains many new features including analog storage and digitization of the analog information. In addition to the new features, the SXVII is intended to operate with interaction times approximately 25 times faster than the original SVX, have the same or better noise characteristics, and have a minimal increase in power. The SVXII is an engineering challenge. This report is a first detailed attempt to introduce the SVXIII to the user. Knowledge of the original SVX and its operation would be helpful and can be obtained from references 1–3.

28302 (FNAL-TM–1894) **Optimization of CMS HCAL parameters using hanging file test data.** Green, D. Fermi National Accelerator Lab., Batavia, IL (United States). Jun 1994. 15p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH03000. Order Number DE94015726. Source: OSTI; NTIS; INIS; GPO Dep.

There are 2 basic choices for the magnetic solenoid coil location in large collider experiments. One can place the coil inside the calorimeter radius as in CDF, DO, ATLAS, and SDC. Alternatively, one can place the coil outside the calorimetry as in SLD, ZEUS, and CMS. There are clearly definite advantages to both schemes since different collaborations have chosen different topologies. In this note we examine the consequences of the second choice, which places no significant material in front of the EM compartment, but severely limits the total depth of hadronic calorimetry (HCAL) available before the appearance of inert material (the coil).

28303 (FNAL-TM–1895) **A high speed, wide dynamic range digitizer circuit for photomultiplier tubes.** Yarema, R.J. (Fermi National Accelerator Lab., Batavia, IL (United States)); Foster, G.W.; Knickerbocker, K.; Sarraj, M.; Tschirhart, R.; Whitmore, J.; Zimmerman, T.; Lindgren, M. Fermi National Accelerator Lab., Batavia, IL (United States). Jun 1994. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH03000. (CONF-9405168–3: 6. Pisa meeting on advanced detectors, Elba (Italy), 22-28 May 1994). Order Number DE94015187. Source: OSTI; NTIS; INIS; GPO Dep.

High energy physics experiments running at high interaction rates frequently require long record lengths for determining a level 1 trigger. The easiest way to provide a long event record is by digital means. In applications requiring wide dynamic range, however, digitization of an analog signal to obtain the digital record has been impossible due to lack of high speed, wide range FADCs. One such application is the readout of thousands of photomultiplier tubes in fixed target and colliding beam experiment calorimeters. A circuit has been designed for digitizing PMT signals over a wide dynamic range (17–18 bits) with 8 bits of resolution at rates up to 53 MHz.

Output from the circuit is in a floating point format with a 4 bit exponent and an 8 bit mantissa. The heart of the circuit is a full custom integrated circuit called the QIE (Charge Integrator and Encoder). The design of the QIE and associated circuitry reported here permits operation over a 17 bit dynamic range. Tests of the circuit with a PMT input and a pulsed laser have provided respectable results with little off line correction. Performance of the circuit for demanding applications can be significantly enhanced with additional off line correction. Circuit design, packaging issues, and test results of a multirange device are presented for the first time.

28304 (FRCEA-TH–422) **Quantification, by induced photofissions, of low-level transuranics in bulk solid wastes.** Lyoussi, A. CEA Centre d'Etudes de Saclay, 91 - Gif-sur-Yvette (France). Dept. d'Electronique et d'Instrumentation Nucleaire; Clermont-Ferrand-2 Univ., 63 - Aubiere (France). Feb 1994. 230p. (In French). Order Number DE94632804. Source: OSTI; NTIS (US Sales Only); INIS.

A comprehensive programme is currently in progress at several laboratories for the development of sensitive, practical and non destructive assay techniques for the quantification of low-level transuranics (TRU) in bulk solid wastes. Over the last few years, considerable progress has been made in the field of assay techniques for low-level α contaminated wastes. The chapter I of the first part of this report contains a wide survey of these developments. The present document presents an active detection method for radioactive wastes embedded in high-density matrices, mainly concrete packages. The high density of the packages, as well as their high water content (up to 25%), means only high-energy neutrons or gamma particles have a high enough range to activate the enclosed actinides. Our aims were to evaluate the feasibility of dosing transuranians by induced photofission, and to optimize an experimental system with a view to improving detection limits. The system uses a pulsed electron beam from a linear accelerator (LINAC) to produce high-energy photon bursts from a metallic converter. The photons induce fissions in TRU. When a fission is induced in trace amounts of TRU contaminants in waste material, it provides 'signatures' from fission products that can be used to assay the material before disposal. We give here the results from counting photofission-induced delayed neutrons from ^{239}Pu, ^{235}U and ^{238}U in three sample matrices : glass, polyethylene and concrete. We counted delayed neutrons emitted after each pulse of the LINAC using the 'Sequential PHoton Interrogation and Neutron Counting Signatures' (SPHINCS) technique which had been developed in this thesis work. Finally, use of an electron linear accelerator as a particle source, experimental and electronics details, measurements results and their interpretation and a future experimental works are discussed. (author). 53 refs., 2 annexes.

28305 (FRCEA-TH–423) **Modelization and treatment of signals issued of neutronic detectors: neutrons and gamma separation.** Ousi Benomar, K. CEA Centre d'Etudes de Saclay, 91 - Gif-sur-Yvette (France). Dept. d'Electronique et d'Instrumentation Nucleaire; Paris-11 Univ., 91 - Orsay (France). Jan 1994. 184p. (In French). Order Number DE94632805. Source: OSTI; NTIS (US Sales Only); INIS.

In this thesis we present an original methodology permitting to separate the neutron and the gamma response of a detector. This methodology use algorithms based on the utilisation of statistics of superior order (Campbell theorem generalization). 45 figs., 54 refs., 1 annexe.

28306 (FZR–38(prepr.)) **Particle identification in a wide dynamic range based on pulse-shape analysis with solid-state detectors.** Pausch, G. (Freie Univ. Berlin (Germany). Fachbereich Physik); Bohne, W.; Hilscher, D.; Ortlepp, H.G.; Polster, D. Forschungszentrum Rossendorf e.V. (FZR), Rossendorf bei Dresden (Germany). Apr 1994. 10p. Sponsored by Bundesministerium fuer Forschung und Technologie, Bonn (Germany). Foerderkennzeichen BMFT 06OB115. Order Number DE94789740. Source: OSTI; NTIS (US Sales Only); INIS.

Heavy ions detected in a planar silicon detector were identified by exploiting a recently proposed combination of the pulse-shape and the time-of-flight techniques. We were able to resolve charge numbers up to Z = 16 within a wide dynamic range of $\approx$ 1:5, and to identify even isotopes for the elements up to Magnesium. The simple scheme of signal processing is based on conventional electronics and cheap enough to be exploited in large multidetector arrays. (orig.)

28307 (JAERI-M–93-228, pp. 997-1003) **Thermo-lumino detector for a neutron diffraction.** Hidaka, Masanori (Kyushu Univ., Fukuoka (Japan). Dept. of Physics); Morisako, Tsuneo; Nishi, Masakazu. Japan Atomic Energy Research Inst., Tokyo (Japan). Nov 1993. (CONF-9303258–: 5. international symposium on advanced nuclear energy research, Mito (Japan), 10-12 Mar 1993; JAERI-CONF–2). In *Proceedings of the fifth international symposium on advanced nuclear energy research: Neutrons as microscopic probes.* 1101p. Order Number DE94748692. Source: OSTI; NTIS; INIS.

We have been developing a new detector system for the neutron diffraction camera. The system is mainly based on a thermoluminescence effect. The thermoluminescence sheet is made of a thermal luminosity being fine powders of rare earth doped $BaSO_4$ phosphors, and a (n-α) reactor of $^{10}B_2O_3$ compound. The ionising radiations of the α-particles excite the thermal luminosity, and its stored energy is emitted as the thermoluminescence of about 370 nm on heating up to about 250degC. Two-dimensional thermoluminescences are detected and amplified by an imaging intensifier and converted by a CCD camera to electrical signals (vision image data). A computerized vision system can handle the signals and analyze the vision image. After gathering the thermoluminescences, the thermo-lumino sheets can be cyclically used by an annealer which eliminates the recorded image data. (author).

28308 (JINR–13-91-391) **Electronic-computer units of the meso-optical Fourier transform microscope with one-channel photodetectors and with CCD-matrix.** Astakhov, A.Ya. (and others); Kishvardi, A.; Krasnoslobodtsev, V.I. Joint Inst. for Nuclear Research, Dubna (Russian Federation). Lab. of Nuclear Problems. 1991. 7p. (In Russian). Order Number DE94632795. Source: OSTI; NTIS (US Sales Only); INIS.

The electronic-computer units of the meso-optical Fourier transform microscope (MFTM) with one-channel photodetectors and of the MFTM with CCD-matrix are described. The new variant of the MFTM electronics is nuilt up from reading channel, CCD TV camera interface, array of the 16 amplifiers, 16 channel interface for the photoresistors and opto-electronic limit swiths of the X-Y stage of the MFTM. 2 refs.; 6 figs.

28309 (JINR–13-91-423) **Track regression effects in polyethylenetetraphtalate after sensitization by different methods.** Apel', P.Yu. Joint Inst. for Nuclear Research, Dubna (Russian Federation). Lab. of Nuclear Problems. 1991. 8p. (In Russian). Order Number DE94632796. Source: OSTI; NTIS (US Sales Only); INIS.

Submitted to Prib. Tekh. Ehksp.

The aging effect for tracks in polyethylenetetraphtalate film irradiated with 1 MeV/amu xenon ions was investigated after the sensitization by differt methods (UV exposure and treatment with a solvent). It was found that after the treatment with the solvent the fast regression of the tracks occurs during the storage of the detector, whereas after the UV irradiation the tracks are stable for ten years. 7 refs.; 4 figs.

28310 (JINR-E–1-91-412) **Possibility of using RICH-detectors in a trigger.** Butenko, V.A. (and others); Grebenyuk, V.M.; Drozdov, V.A. Joint Inst. for Nuclear Research, Dubna (Russian Federation). Lab. of Nuclear Problems. 1991. 14p. Order Number DE94632792. Source: OSTI; NTIS (US Sales Only); INIS.

A method for the fast charged hadrons identification by RICH-detectors, which can be used in the low level trigger, is proposed for the multi-particle spectrometer UNK. A main goal of this method - using magnetic field to determine fast enough both the particle momentum (and Cherenkov ring diameter) and coordinate of the Cherenkov ring image center in the photodetector plane. Authors propose to have the decision about a type of secondary particle by Rich-detectors faster than 1 μs and believe that this method can be applied further in.

28311 (JINR-R–10-91-419) **RPC-testing and preparation of card array for the experiment.** Popov, A.A.; Khachaturov, B.A.

Joint Inst. for Nuclear Research, Dubna (Russian Federation). Lab. of Nuclear Problems. 1991. 14p. (In Russian). Order Number DE94632793. Source: OSTI; NTIS (US Sales Only); INIS.

This paper consists of the short description about the hardware and software for testing of the electronical channel array for the proportional chambers which is produced on the base of the RPC-32 recording cards. Some data are shown for N≃ 15500 channels after their's testing. 3 refs.; 8 figs.; 2 tabs.

28312 (JINR-R–13-91-299) **Meso-optical Fourier microscope with one-channel photodetectors.** Astakhov, A.Ya. (and others); Kishvaradi, A.; Krasnoslobodtsev, V.I. Joint Inst. for Nuclear Research, Dubna (Russian Federation). Lab. of Nuclear Problems. 1991. 12p. (In Russian). Order Number DE94632794. Source: OSTI; NTIS (US Sales Only); INIS.

The meso-optical Fourier transform microscope (MFTM) with one-channel photodetectors is described. The illuminating system of the nuclear emulsion is given. Four basis versions of the illuminating system of the nuclear emulsion are presented. There are presented the results of the experimental testing of the device with straight line particle tracks of high ionization level. The comparison of the MFTM with CCD-matrix and of the MFTM with one-channel photodetectors is made in conclusion. 12 refs.; 13 figs.

28313 (KEK-PROC–93-7, pp. 179-181) **Consideration for residual beam oscillation due to the noise of oscillation detector of transverse feedback system.** Hanaoka, Kenji (National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan)). National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan). Jun 1993. (CONF-9211172–: International workshop on B factories: accelerators and experiments, Tsukuba (Japan), 17-20 Nov 1992). In *Proceedings of international workshop on B-factories: accelerators and experiments (BFWS92).* 435p. Order Number DE94737962. Source: OSTI; NTIS; INIS.

When luminosity reduction is caused by only geometrical reduction due to miss-collision, we should calculate required resolution of oscillation detector which causes miss-collision. At least we have to calculate an expected value of amplitude of residual oscillation which is caused by the noise of oscillation detector. In this Proceeding, expected amplitude of residual beam oscillation is reviewed as a function of the resolution of the oscillation detector and feedback damping time of the transverse feedback. (author).

28314 (KEK-PROC–93-7, pp. 271-276) **Triggering and data acquisition for a PEP II detector.** Innes, W.R. (Stanford Linear Accelerator Center, CA (United States)). National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan). Jun 1993. (CONF-9211172–: International workshop on B factories: accelerators and experiments, Tsukuba (Japan), 17-20 Nov 1992). In *Proceedings of international workshop on B-factories: accelerators and experiments (BFWS92).* 435p. Order Number DE94737962. Source: OSTI; NTIS; INIS.

This talk reports on the current plan for the PEP II detector data acquisition system. The organization described is based on a data driven architecture. (author).

28315 (KEK-PROC–93-7, pp. 286-291) **The Gismo project.** Breakstone, A. (Hawaii Univ., Honolulu, HI (United States)). National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan). Jun 1993. (CONF-9211172–: International workshop on B factories: accelerators and experiments, Tsukuba (Japan), 17-20 Nov 1992). In *Proceedings of international workshop on B-factories: accelerators and experiments (BFWS92).* 435p. Order Number DE94737962. Source: OSTI; NTIS; INIS.

We describe Gismo, which is a software project to use object-oriented programming techniques to simulate detectors and reconstruct events. Gismo consists of a kernel, written in C_{++}, with extensions to do detector and event input and output, graphics, and the use of a graphical user interface. We give the current status of the project and future plans. (author).

28316 (KEK-PROC–93-7, pp. 304-306) **Particle identification via dE/dx in CLEO II.** Kinoshita, K. (Harvard Univ., Cambridge, MA (United States)). National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan). Jun 1993. (CONF-9211172–: International workshop on B factories: accelerators and experiments, Tsukuba (Japan), 17-20 Nov 1992). In *Proceedings of international workshop on B-factories: accelerators and experiments (BFWS92).* 435p. Order Number DE94737962. Source: OSTI; NTIS; INIS.

Measurements of dE/dx in the central tracking chambers contribute to particle identification in the CLEO II experiment. The detector, measurement and calibration are described. Achieved resolution and plans are discussed. (author).

28317 (KEK-PROC–93-7, pp. 307-314) **TOF counter design for KEK B-factory.** Kichimi, Hiromichi (National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan)). National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan). Jun 1993. (CONF-9211172–: International workshop on B factories: accelerators and experiments, Tsukuba (Japan), 17-20 Nov 1992). In *Proceedings of international workshop on B-factories: accelerators and experiments (BFWS92).* 435p. Order Number DE94737962. Source: OSTI; NTIS; INIS.

The design of TOF counter for KEK B-Factory and the related R and D works are described. The counter design relies on use of fine-mesh-dynode photomultiplier tubes in a 1 T field. The test results of the prototype counters indicate that a goal of 100 ps or better time resolution is achievable. (author).

28318 (KEK-PROC–93-7, pp. 315-318) **Studies of silica aerogel as a low-mass particle identification system for the SLAC B factory detector.** Eigen, G. (California Inst. of Tech., Pasadena, CA (United States)); Hitlin, D.G.; Oyang, J.Y. National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan). Jun 1993. (CONF-9211172–: International workshop on B factories: accelerators and experiments, Tsukuba (Japan), 17-20 Nov 1992). In *Proceedings of international workshop on B-factories: accelerators and experiments (BFWS92).* 435p. Order Number DE94737962. Source: OSTI; NTIS; INIS.

A threshold Cerenkov counter using low density silica aerogels with n=1.008 and 1.06 can provide excellent particle identification for an asymmetric B Factory detector. We have been exploring the possibility of collecting Cerenkov photons in such aerogels with newly developed large area avalanche photodiodes operated in the linear regime. Results on photon yield are compared to a quartz-windowed photomultiplier tube readout. (author).

28319 (KEK-PROC–93-7, pp. 319-325) **R and D on aerogel Cherenkov counter for KEK B-factory.** Adachi, Ichiro (National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan)). National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan). Jun 1993. (CONF-9211172–: International workshop on B factories: accelerators and experiments, Tsukuba (Japan), 17-20 Nov 1992). In *Proceedings of international workshop on B-factories: accelerators and experiments (BFWS92).* 435p. Order Number DE94737962. Source: OSTI; NTIS; INIS.

Recent R and D works on aerogel Cherenkov counter for KEK B-Factory are presented. (author).

28320 (KEK-PROC–93-7, pp. 331-341) **The DIRC counter: a new type of particle identification device for B Factories.** Ratcliff, B. (Stanford Linear Accelerator Center, CA (United States)). National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan). Jun 1993. (CONF-9211172–: International workshop on B factories: accelerators and experiments, Tsukuba (Japan), 17-20 Nov 1992). In *Proceedings of international workshop on B-factories: accelerators and experiments (BFWS92).* 435p. Order Number DE94737962. Source: OSTI; NTIS; INIS.

A very thin, solid radiator, totally internally reflecting, imaging Cherenkov counter (DIRC) is described. This device is well matched to the hadronic charged particle identification requirements at an asymmetric e^+e^- B Factory. (author).

28321 (KEK-PROC–93-7, pp. 342-349) **Tracking system for KEK B-factory.** Uno, Shoji (National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan)). National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan). Jun 1993. (CONF-9211172–: International workshop on B factories: accelerators and experiments, Tsukuba (Japan), 17-20 Nov 1992). In *Proceedings of international workshop on B-factories: accelerators and experiments (BFWS92).* 435p. Order Number DE94737962. Source: OSTI; NTIS; INIS.

We tested a small-cell drift chamber filled with a mixture of 50% helium and 50% ethane in a 1 Tesla magnetic field. A good spatial resolution (σ_x = 88 ± 2μm) and a good dE/dx resolution ($\sigma_{dE/dx}$/dE/dx = 10.1 ± 0.2% with 10 samplings) were obtained. The energy loss as a function of $\beta\gamma$ was measured. The x-t relation and the spatial resolution were reproduced by a Monte Carlo simulation. Measured gas gain variation along the stereo wire of a 2.2m long chamber was consistent with the calculation. A preliminary radiation damage test was carried out. (author).

28322 (KEK-PROC–93-7, pp. 356-360) **Resistive plate counters for muon detection.** Morgan, N. (Virginia Polytechnic Inst. and State Univ., Blacksburg, VA (United States). Dept. of Physics). National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan). Jun 1993. (CONF-9211172–: International workshop on B factories: accelerators and experiments, Tsukuba (Japan), 17-20 Nov 1992). In *Proceedings of international workshop on B-factories: accelerators and experiments (BFWS92).* 435p. Order Number DE94737962. Source: OSTI; NTIS; INIS.

We are considering resistive plate counters as a possible technology for use as muon detectors in a B-factory experiment. A brief history and description of the performance of resistive plate counters is presented. Prototype test results demonstrate that these counters are capable of providing adequate time and spatial information in a compact detector. Time resolution of 2 ns and spatial resolution of less than 1 mm have been obtained in 30 x 30 cm polyvinylchloride resistive plate counters. These counters have operated with no degradation in performance while being radiated with 10 Hz/cm^2 from radioactive sources. Test results are presented and future plans are outlined. (author).

28323 (KEK-PROC–93-7, pp. 361-367) **R and D activities for the vertex detector in KEK B-factory.** Haba, Junji (Osaka Univ., Toyonaka (Japan). Dept. of Physics). National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan). Jun 1993. (CONF-9211172–: International workshop on B factories: accelerators and experiments, Tsukuba (Japan), 17-20 Nov 1992). In *Proceedings of international workshop on B-factories: accelerators and experiments (BFWS92).* 435p. Order Number DE94737962. Source: OSTI; NTIS; INIS.

Recent activities in the vertex detector development for the KEK-B factory are presented. (author).

28324 (KEK-PROC–93-7, pp. 368-376) **Electromagnetic calorimeter for KEK B factory.** Fukushima, Masaki (National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan)). National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan). Jun 1993. (CONF-9211172–: International workshop on B factories: accelerators and experiments, Tsukuba (Japan), 17-20 Nov 1992). In *Proceedings of international workshop on B-factories: accelerators and experiments (BFWS92).* 435p. Order Number DE94737962. Source: OSTI; NTIS; INIS.

A design of high resolution electromagnetic calorimeter for KEK B factory is reported. The entire calorimeter consists of ≈9400 pieces of CsI(Tl) and covers the polar angle region of 12deg - 160deg. The crystals are read out by silicon photodiodes of 4 cm^2 total sensitive area followed by low noise preamplifiers. The energy resolution is expected to be ≈2% for photons with energy higher than 0.5 GeV. (author).

28325 (LA-SUB–94-118) **CDF experiments at Fermilab and the SDC experiment at the SSC Laboratory.** Los Alamos National Lab., NM (United States); New Mexico Univ., Albuquerque, NM (United States). Dept. of Physics and Astronomy. [1993]. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. Order Number DE94016569. Source: OSTI; NTIS; INIS; GPO Dep.

This report discusses: SVX II detectors; SVX II data acquisition systems; radiation damage studies in silicon detectors; KEK beam test of SDC double sided silicon detectors; and SDC silicon module testing program.

28326 (LA-UR–94-1591) **Response of alkali halide scintillators to neutrons from 5 to 100 MeV.** Bartle, C.M. (Inst. of Geophysical and Nuclear Sciences, Lower Hutt, (New Zealand)); Haight, R.C. Los Alamos National Lab., NM (United States). [1994]. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-940507–27: International conference on nuclear data for science and technology, Gatlinburg, TN (United States), 9-13 May 1994). Order Number DE94014799. Source: OSTI; NTIS; INIS; GPO Dep.

The response of three alkali halide scintillator's to neutrons in the range 5 to 100 MeV was investigated with the spallation neutron source at LAMPF/WNR. Scintillating crystals were NaI(Tl), KI(Tl) and CsI(Tl), each 2.5 cm in diameter and 1.2 cm thick. Pulse shapes that depend on particle type were observed for NaI(Tl) and CsI(Tl) but not for KI(Tl). Pulse height spectra for are reported as a function of neutron energy, and, where pulse shape discrimination was observed, for individual charged-particle groups.

28327 (LA-UR–94-2203) **Performance checks with the Alpha Sentry CAM.** Rodgers, J.C. Los Alamos National Lab., NM (United States). [1994]. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-9406210–2: Health Physics Society annual meeting, San Francisco, CA (United States), 27-30 Jun 1994). Order Number DE94016083. Source: OSTI; NTIS; GPO Dep.

Before a CAM is put into service, it must be calibrated. The flow meter and detector must be calibrated with an external flow meter to provide accurate flow data, and the detector must be calibrated to produce accurate DPM data. Both flow and DPM data enter into the calculation of the Derived Air Concentration exposure (DAC-hr) by the CAM software. The focus of this report is on methods for checking that the DAC-hr alarm functionality has been properly calibrated and available in installed CAM instruments. The process begins with detector calibration. In order to calibrate the detector, the Alpha Sentry CAM is placed in an off-line calibration mode and detector efficiency calibration is selected. The user is prompted to enter the calibration source DPM and place the source in the CAM head. Upon latching the filter door with the source in place, a count is automatically initiated and completed. From the count data and the user entered DPM data, an efficiency is determined in the Alpha Sentry Manager (ASM) and stored in non-volatile memory in the CAM head electronics. This source is typically a plated ^{239}Pu or ^{241}Am source diffused into a stainless steel planchet.

28328 (LA-UR–94-2313) **A large multiplicity counter for the measurement of bulk plutonium.** Langner, D.G. (Los Alamos National Lab., NM (United States). Safeguards Assay Group); Krick, M.S.; Kroncke, K.E. Los Alamos National Lab., NM (United States). [1994]. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-940748–46: Institute of Nuclear Materials Management annual meeting, Naples, FL (United States), 17-20 Jul 1994). Order Number DE94016061. Source: OSTI; NTIS; INIS; GPO Dep.

The authors have considered the problem of designing a thermal neutron counter for the neutron multiplicity measurement of large, high-mass plutonium items. Three neutron multiplicity counters have been built at Los Alamos to date; two are used for in-plant applications. The third counter is an experimental prototype and is used for research. The sample cavities of these counters can accommodate only relatively small samples. The largest item that can be measured optimally by the largest of these counters is 20 cm wide by 36 cm high. Now that the multiplicity technique has proven to be accurate and timely for the measurement of plutonium-bearing items, several facilities in the DOE complex have identified the need for larger counters. Several sources have identified a counter that could measure items contained in 30-gal. drums as the most desirable. For a multiplicity measurement to be successful, the neutron counter must have a large detection efficiency independent of changes in the neutron energy of the emitted neutrons, a short die-away time, and a uniform response over the sample cavity. These requirements have been achieved in the smaller counters by using large numbers of ^{3}He tubes placed in concentric rings. This method can be extrapolated to a larger counter but at great expense. The authors have conducted a design study for a 30-gal. drum counter. The goal of this study is to reduce the number of ^{3}He tubes required for such a large counter while still maintaining good measurement performance. This paper will report on the result of this study.

28329 (LA-UR–94-2418) **Practical alpha detectors for site characterization.** Bounds, J.A.; Allander, K.S.; Bolton, R.B.; Garner, S.E.; Johnson, J.D.; Johnson, J.P.; MacArthur, D.W.; Sprouse, L.L.; Walters, S.G. Los Alamos National Lab., NM (United States). [1994]. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-940815–72: International nuclear and hazardous waste management conference, Atlanta, GA (United States), 14-18 Aug 1994). Order Number DE94016292. Source: OSTI; NTIS; INIS; GPO Dep.

The authors have and are developing a series of practical alpha detectors for alpha characterization. These include soil surface monitors, pipe and duct monitors, air quality and radon monitors, tool monitors, and sample monitors. Two types of these monitors have been transferred to industry thus far for commercialization. Several of these systems have been fully field tested: for example, the soil surface monitor has been used to characterize 11 sites for 7 customers at 3 DOE facilities. Using a new but simple technology, these alpha detectors can be put to use in many areas where conventional alpha probes are impractical or insufficiently sensitive. Use of these alpha detectors in site characterization at the Uranium in Soil Integrated Demonstration at Fernald, at Los Alamos, and elsewhere will be discussed as well as their commercialization and possible further applications.

28330 (LA-UR–94-2502) **Portable shift register.** Halbig, J.K.; Bourret, S.C.; Hansen, W.J.; Hicks, D.V.; Klosterbuer, S.F.; Krick, M.S. Los Alamos National Lab., NM (United States). [1994]. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-940748–71: Institute of Nuclear Materials Management annual meeting, Naples, FL (United States), 17-20 Jul 1994). Order Number DE94016087. Source: OSTI; NTIS; INIS; GPO Dep.

An electronics package for a small, battery-operated, self-contained, neutron coincidence counter based on a portable shift-register (PSR) has been developed. The counter was developed for applications not adequately addressed by commercial packages, including in-plant measurements to demonstrate compliance with regulations (domestic and international), in-plant process control, and in-field measurements (environmental monitoring or safeguards). Our package's features, which address these applications, include the following: Small size for portability and ease of installation;battery or mains operation; a built-in battery to power the unit and a typical detector such as a small sample counter, for over 6 h if power lines are bad or noisy, if there is a temporary absence of power, or if portability is desired; complete support, including bias, for standard neutron detectors; a powerful communications package to easily facilitate robust external control over a serial port; and a C-library to simplify creating external control programs in computers or other controllers. Whereas the PSR specifically addresses the applications mentioned above, it also performs all the measurements made by previous electronics packages for neutron coincidence counters developed at Los Alamos and commercialized. The PSR electronics package, exclusive of carrying handle, is 8 by 10 by 20 cm; it contains the circuit boards, battery, and bias supply and weighs less than 2 kg. This instrument package is the second in an emerging family of portable measurement instruments being developed; the first was the Miniature and Modular Multichannel Analyzer (M^3CA). The PSR makes extensive use of hardware and software developed for the M^3CA; like the M^3CA, it is intended primarily for use with an external controller interfaced over a serial channel.

28331 (LBL–35435) **Improved electrical and transport characteristics of amorphous silicon by enriching with microcrystalline silicon.** Mireshghi, A.; Hong, W.S.; Drewery, J.; Jing, T.; Kaplan, S.N.; Lee, H.K.; Perez-Mendez, V. Lawrence Berkeley Lab., CA (United States). Apr 1994. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00098. (CONF-940411–42: Spring meeting of the Materials Research Society, San Francisco, CA (United States), 4-8 Apr 1994). Order Number DE94014927. Source: OSTI; NTIS; INIS; GPO Dep.

The authors have deposited n-i-p diodes with microcrystalline intrinsic layers for radiation detection applications. The diodes show interesting electrical characteristics which have not been reported before. From TOF measurement for their best samples, the authors obtained μ_e values which are about 3 times larger than their standard a-Si:H. for $\mu\tau$ values approximately a factor of 2 improvement was observed. The N^*_D values derived from hole-onset measurements show lower ionized dangling bond density than normal a-Si:H material. The authors propose a simple model which can very well explain the experimental results.

28332 (MPI-PhE–93-34) **A massive cryogenic particle detector with good energy resolution.** Ferger, P. (Max-Planck-Institut fuer Physik, Muenchen (Germany). Werner-Heisenberg-Institut); Colling, P.; Cooper, S.; Dummer, D.; Frank, M. Max-Planck-Institut fuer Physik, Muenchen (Germany). Werner-Heisenberg-Institut. Dec 1993. 9p. Order Number DE94786364. Source: OSTI; NTIS (US Sales Only); INIS.

Massive cryogenic particle detectors are being developed for use in a search for dark matter particles. Results with a 31 g sapphire crystal and a superconducting phase transition thermometer operated at 44 mK are presented. The observed signal includes a fast component which is significantly larger than the expected thermal pulse. The energy resolution is 210 eV (FWHM) for 6 keV X-rays. (orig.)

28333 (MPI-PhE–94-01) **A calorimetric particle detector using an iridium superconducting phase transition thermometer.** Frank, M. (Max-Planck-Institut fuer Physik, Muenchen (Germany)); Dummer, D.; Cooper, S.; Igalson, J.; Proebst, F.; Seidel, W. Max-Planck-Institut fuer Physik, Muenchen (Germany). Werner-Heisenberg-Institut. Jan 1994. 24p. Order Number DE94786365. Source: OSTI; NTIS (US Sales Only); INIS.

We report on a calorimetric particles detector consisting of an 18.3 g silicon crystal and an iridium superconducting phase transition thermometer. The cryogenic calorimeter and the associated apparatus are described in detail. The pulses from irradiation with an α-particle source have a large unexpected overshoot in addition to the component expected from a naive thermal model. The pulse height spectrum displays an energy resolution of 1 percent FWHM at 6 MeV and good linearity. The noise, electrothermal feedback, and position dependence are discussed. (orig.)

28334 **Electronic test circuitry.** Brown, R.A. To Dept. of Energy. 1992. Filed date 12 Jun 1992. U.S. Patent Application 7-897,409. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC12-76SN00052. Order Number DE94014888. Source: OSTI; NTIS; GPO Dep.

Circuitry for testing the ability of an intermediate range nuclear instrument to detect and measure a constant current and a periodic current pulse. The invention simulates the resistance and capacitance of the signal connection of a nuclear instrument ion chamber detector and interconnecting cable. An LED flasher/oscillator illuminates an LED at a periodic rate established by a timing capacitor and circuitry internal to the flasher/oscillator. When the LED is on, a periodic current pulse is applied to the instrument. When the LED is off, a constant current is applied. An inductor opposes battery current flow when the LED is on.

28335 **Tritium monitor.** Chastagner, P. To Dept. of Energy. 1992. Filed date 21 Aug 1992. U.S. Patent Application 7-933,155. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035. Order Number DE94016117. Source: OSTI; NTIS; INIS; GPO Dep.

This invention is comprised of a system for continuously monitoring the concentration of tritium in an aqueous stream. The system pumps a sample of the stream to magnesium-filled combustion tube which reduces the sample to extract hydrogen gas. The hydrogen gas is then sent to an isotope separation device where it is separated into two groups of isotopes: a first group of isotopes containing concentrations of deuterium and tritium, and a second group of isotopes having substantially no deuterium and tritium. The first group of isotopes containing concentrations of deuterium and tritium is then passed through a tritium detector that produces an output proportional to the concentration of tritium detected. Preferably, the detection system also includes the necessary automation and data collection equipment and instrumentation for continuously monitoring an aqueous stream.

28336 Radiation detector using a bulk high T_c superconductor. Artusom, J.F.; Franks, L.A.; Hull, K.L.; Symko, O.G. To Dept. of Energy. 1992. Filed date 8 Sep 1992. U.S. Patent Application 7-941,837. 15p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC08-88NV10617. Order Number DE94016103. Source: OSTI; NTIS; INIS; GPO Dep.

A radiation detector is provided, wherein a bulk high T superconducting sample is placed in a magnetic field and maintained at a superconducting temperature. Photons of incident radiation will cause localized heating in superconducting loops of the sample destroying trapped flux and redistributing the fluxons, and reducing the critical current of the loops. Subsequent cooling of the sample in the magnetic field will cause trapped flux redistributed Abrikosov fluxons and trapped Josephson fluxons. The destruction and trapping of the fluxons causes changes in the magnetization of the sample inducing currents in opposite directions in a pickup coil which is coupled by an input coil to an rf SQUID).

28337 (PNL-SA–24272) **Scintillating glass fiber neutron senors.** Abel, K.H.; Arthur, R.J.; Bliss, M. Pacific Northwest Lab., Richland, WA (United States). Apr 1994. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. (CONF-940524–13: 8. symposium on radiation measurements and applications, Ann Arbor, MI (United States), 16-19 May 1994). Order Number DE94015213. Source: OSTI; NTIS; GPO Dep.

Cerium-doped lithium-silicate glass fibers have been developed at Pacific Northwest Laboratory (PNL) for use as thermal neutron detectors. By using highly-enriched ^{6} Li , these fibers efficiently capture thermal neutrons and produce scintillation light that can be detected at the ends of the fibers. Advantages of scintillating fibers over ^{3}He or BF_3 proportional tubes include flexibility in geometric configuration, ruggedness in high-vibration environments, and less detector weight for the same neutron sensitivity. This paper describes the performance of these scintillating fibers with regard to count rates, pulse height spectra, absolute efficiencies, and neutron/gamma discrimination. Fibers with light transmission lengths (1/e) of greater than 2 m have been produced at PNL. Neutron sensors in fiber form allow development of a variety of neutron detectors packaged in previously unavailable configurations. Brief descriptions of some of the devices already produced are included to illustrate these possibilities.

28338 (PNL-SA–24509) **Achieving low backgrounds in a variety of situations.** Miley, H.S. (Pacific Northwest Lab., Richland, WA (United States)); Brodzinski, R.L.; Reeves, J.H.; Avignone, F.T. Pacific Northwest Lab., Richland, WA (United States). Apr 1994. 16p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. (CONF-940494–1: International workshop on superconductivity and particle detection, Toledo (Spain), 20-24 Apr 1994). Order Number DE94015208. Source: OSTI; NTIS; GPO Dep.

To be sufficiently interesting, a physics experiment must measure a process that is relatively rare. The process may be rare due to small cross sections, low detector mass, or low detector efficiency. In any case, the process of interest must compete with processes in the detector's environment that are much more prolific. Although these processes may have been of interest last year, they serve only to hide signals of interest today. The most common method of background reduction is to construct a lead shield around the detector. A less common technique is to reconstruct a detector apparatus with materials with a lower specific activity. The effects of cosmic rays are also frequently reduced by using an active veto system or relocating underground. However, the judicious use of these and other techniques requires some knowledge of the vulnerability of the detector and the relative sizes of potential backgrounds. The Pacific Northwest Laboratory-University of South Carolina (PNL-USC) double beta-decay collaboration and more recently the International Germanium Experiment (IGEX) collaboration have accrued a great deal of experience with semiconductor detectors operated above ground, in shallow below-ground locations (36 m), and in several deep underground locations. The effect of low-background materials, coincidence techniques, cosmic neutrons, and ubiquitous uranium and thorium decay products will be discussed as a function of depth and specifically for above-ground experiments.

28339 (TRI-PP–91-6) **A beam intensity profile monitor based on secondary electron emission.** Berdoz, A.R. (Manitoba Univ., Winnipeg, MB (Canada). Dept. of Physics); Birchall, J.; Campbell, J.R.; Davis, C.A.; Davison, N.E.; Mosscrop, D.R.; Page, S.A.; Ramsay, W.D.; Sekulovich, A.M.; Van Oers, W.T.H.; Green, P.W.; Korkmaz, E.; Roy, G.; Soukup, J.; STRIUMF, Vancouver, BC (Canada). Mar 1991. 22p. Order Number DE94632799. Source: OSTI; NTIS (US Sales Only); INIS.

Submitted to Nuclear Instruments and Methods.

Two dual function intensity profile monitors have been designed for a measurement of parity violation in antiproton-proton scattering at about 230 MeV using longitudinally polarized protons. Each device contains a set of split secondary electron emission (SEM) foils to determine the median of the beam current distribution (in x and y). The split foils, coupled through servoamplifiers and operational amplifiers to upstream air core steering magnets, have demonstrated the ability to hold the beam position stable to within $\pm$ 3 μm after one hour of data taking with a 100 nA, 15 mm FWHM Gaussian beam. (Author) 16 refs., 10 figs., tab.

28340 (TRI-PP–91-13) **Pulse pile-up III: Refinements to ruin theory.** Wilkinson, D.H. (Sussex Univ., Brighton (United Kingdom)). TRIUMF, Vancouver, BC (Canada). May 1991. 11p. Order Number DE94632797. Source: OSTI; NTIS (US Sales Only); INIS.

Submitted to Nuclear Instruments and Methods.

The study of higher-order corrections to ruin theory enhances confidence in its utility and permits the extension of its range of applicability. (Author) 4 refs., 6 figs., tab.

28341 (TRI-PP–91-14) **Pulse pile-up IV: Bipolar pulses.** Wilkinson, D.H. (Sussex Univ., Brighton (United Kingdom)). TRIUMF, Vancouver, BC (Canada). May 1991. 15p. Order Number DE94632798. Source: OSTI; NTIS (US Sales Only); INIS.

Submitted to Nuclear Instruments and Methods.

The study of pulse pile-up is extended from the case of unipolar pulses, for which ruin theory is an excellent approximation, to the case of bipolar pulses for which ruin theory is not applicable to the effect of the back-kicks in reducing the pile-up: an appropriate solution is presented. (Author) 3 refs., 11 figs.

28342 (UCRL-CR–117459) **CSC large panel R&D summary for the SSC GEM muon subsystem.** Pratuch, S.M. (and others); Clements, J.W.; Spellman, G.P. Lawrence Livermore National Lab., CA (United States). May 1994. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. Order Number DE94016175. Source: OSTI; NTIS; INIS; GPO Dep.

The GEM Detector uses 1,128 Cathode Strip Chamber (CSC) muon detectors requiring a total of approximately 10,000 precision panels in the CSC assemblies. These panels must be fabricated to extreme tolerances in order to meet the physics requirement. A fabrication technique used to produce two large panels, nominally 1 by 3 meters, is described and the resulting panel precision is reported.

4402 Radiation Effects On Instrument Components, Instruments, Or Electronic Systems

Refer also to citation(s) 28286

28343 (BNL–60593) **Scintillation mechanism and radiation damage in $Ce_xLa_{1-x}F_3$ crystals.** Wojtowicz, A.J. (Boston Univ., MA (United States)); Wisniewski, D.; Lempicki, A.; Brecher, C.; Bartram, R.H.; Woody, C.; Levy, P.; Stoll, S.; Kierstead, J.; Pedrini, C. Brookhaven National Lab., Upton, NY (United States); Boston Univ., MA (United States). [1994]. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH00016 ; FG02-90ER61033. (CONF-940411–43: Spring meeting of the Materials Research Society, San Francisco, CA (United States), 4-8 Apr 1994). Order Number DE94015848. Source: OSTI; NTIS; INIS; GPO Dep.

Recent spectroscopic and radiation damage experiments on a series of $Ce_xLa_{1-x}F_3$ crystals suggest that the scintillation light output is limited by an unusual quenching mechanism, which also plays a major role in minimizing radiation-induced damage. The intensity of the radiation-induced absorptions is a strong function of

the Ce content x, reaching a maximum for x = 0.03 and a minimum for x = 1. This peculiar dependence appears to be due to the influence of deep-lying Ce levels on both scintillation mechanism and radiation damage. The authors suggest that various charge transfer processes can explain many aspects of the performance of $Ce_xLa_{1-x}F_3$ scintillators.

28344 (CERN–93-04) **Radiation tests on service electronics for future multi TeV detectors.** Larsen, H. (European Organization for Nuclear Research, Geneva (Switzerland)); Schoenbacher, H.; Massam, T.; Wulf, F. European Organization for Nuclear Research, Geneva (Switzerland). 12 Oct 1993. 107p. Order Number DE94632822. Source: OSTI; NTIS (US Sales Only); INIS.

Irradiation tests of a number of essential components for use in the service electronics of the Leading Proton Spectrometer (LPS) have been undertaken. The components are simple medium-scale integrated circuits such as Transistor Transistor Logic (TTL) buffers from the Advanced Low-power Schottky (ALS), Low-power Schottky (LS), and Fast (F) families, optocouplers, and balanced line drivers and receivers. More complex circuits, such as a Fuse Programmable Array Logic chip, programmed as a 6-bit counter, and a complete switched-mode power supply unit were also tested. Further, monolithic voltage regulators with an output potential of 5 V, and 10 MHz quartz oscillator hybrids were tested. The different radiation fields were X-rays (80 keV), ^{60}Co gamma rays, electrons (2.5 MeV), and a high-energy proton accelerator environment. Depending on the device degradation, the maximum dose was up to 0.8 MGy. It is shown that the simple choice of circuit family can achieve a hardness level of nearly 1 MGy(Si), provided that one is prepared to make some sacrifices in power consumption, and in speed. It has been found that this radiation hardness can be reached with LS technology. The maximum level of about 1 MGy(Si) was obtained with 2.5 MeV electrons, which is equivalent to a 1 MeV neutron fluence of the order of $6x10^{13}$ n/cm^2. (orig.).

28345 (HMI-B–512) **Radiation damage in MOS varactors at low temperatures.** Radke, R.E.C. Hahn-Meitner-Institut Berlin GmbH (Germany); Technische Univ. Berlin (Germany). Fachbereich 19 - Elektrotechnik. 1993. 117p. (In German). Order Number DE94789625. Source: OSTI; NTIS (US Sales Only); INIS.

A description of the build-up of charges at low temperatures (T = 80 K) in SiO_2 (MOS-structures) induced by ionizing radiation is presented. The damage is characterized by CV measurements and an expanded analysis is developed. A non-homogeneous distribution of frozen holes in the SiO_2 appears corresponding to the energy deposition. When the radiation is terminated a field dependent ($\geq$ 2 MV/cm) hole transport to the interfaces is observed. Only after warming (T $\geq$ 240 K) the structure interface states are created. (orig./HP)

4404 Well Logging Instrumentation

28346 (PNL–9958) **Calibration facilities at Hanford for gamma-ray and fission-neutron well logging.** Stromswold, D.C. Pacific Northwest Lab., Richland, WA (United States). Jul 1994. 22p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE94015880. Source: OSTI; NTIS; INIS; GPO Dep.

Well-logging tools that detect gamma rays emitted from earth formations need to be calibrated in appropriate facilities to provide quantitative assessments of concentrations o radionuclides based on detected gamma rays. These facilities are typically special models having a hole to insert tools and having sufficient physical size to simulate actual earth formations containing known amounts of radionuclides. The size, generally 3 to 5 feet in diameter and 4 to 6 feet tall, is such that the source of radiation appears infinite in extent to a tool detecting the radiation inside the model. Such models exist at Hanford as concrete cylinders having a central borehole and containing known, enhanced amounts of K, U, and Th. Data collected in these models allow calibration of the logging system to measure radionuclide concentrations in formations around boreholes in the field. The accuracy of the calculated field concentrations depends on the correctness of the original calibration, the statistical precision of the data, and the similarity of the logging conditions to the calibration conditions. Possible methods for analyzing the data collected in the calibration facilities are presented for both spectral and total-count gamma-ray systems. Corrections are typically needed for the effects of steel casing in boreholes and the presence of water rather than air in the holes. Data collected in the calibration models with various steel casings and borehole fluids allow such correction factors to be determined.

4405 Thermal Instrumentation

28347 (CONF-9303122–, pp. 375-379) **Microwave and infrared radiometric observations of water vapor and clouds during the pilot observation experiment.** Westwater, E.R. (Environmental Research Laboratories, Boulder, CO (United States)); Churnside, J.H.; Snider, J.B. USDOE Office of Energy Research, Washington, DC (United States). Mar 1994. From 3. Atmospheric Radiation Measurement (ARM) science team meeting; Norman, OK (United States); 1-5 Mar 1993. In *Proceedings of the third Atmospheric Radiation Measurement (ARM) science team meeting.* 379p. Source: OSTI; NTIS; INIS.

During Phase Two of the Pilot Radiation Observation Experiment (PROBE) held in Kavieng, Papua New Guinea, (January 6 - February 28, 1993) the NOAA Wave Propagation Laboratory operated a dual-frequency microwave water substance radiometer (MWSR) and a Fourier transform infrared radiometer (FTIR). A complete description of the goals of PROBE and of the suite of instruments deployed at the Kavieng site is given in a separate article in this proceedings. In this report, we summarize some of our experiences during PROBE, as well as present some preliminary data that were obtained during this experiment.

28348 (LA-UR–94-1311) **Fiber-optic large area average temperature sensor.** Looney, L.L.; Forman, P.R. Los Alamos National Lab., NM (United States). [1994]. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-9410103–1: 10. optical fibre sensors conference, Glasgow (United Kingdom), 11-13 Oct 1994). Order Number DE94011721. Source: OSTI; NTIS; GPO Dep.

In many instances the desired temperature measurement is only the spatial average temperature over a large area; eg. ground truth calibration for satellite imaging system, or average temperature of a farm field. By making an accurate measurement of the optical length of a long fiber-optic cable, we can determine the absolute temperature averaged over its length and hence the temperature of the material in contact with it.

4406 Optical Instrumentation

Refer also to citation(s) 27556, 27862, 28013, 28034, 28346, 28387, 28391, 28401, 28591, 28594

28349 (CONF-9303122–, pp. 263-266) **Technical progress in the Atmospheric Radiation Measurement Instrument Development Program.** Griffin, J.W. (Pacific Northwest Laboratory, Richland, WA (United States)). USDOE Office of Energy Research, Washington, DC (United States). Mar 1994. From 3. Atmospheric Radiation Measurement (ARM) science team meeting; Norman, OK (United States); 1-5 Mar 1993. In *Proceedings of the third Atmospheric Radiation Measurement (ARM) science team meeting.* 379p. Source: OSTI; NTIS; INIS.

The primary goal of the ARM Instrument Development Program (IDP) is to develop fieldable atmospheric sensing systems which provide a needed atmospheric observation/measurement requisite and are adaptable for sustained deployment at one or more of the ARM Cloud and Radiation Testbeds (CART). A summary of ARM IDP project status including project titles, principal investigators, institutions, and current instrument status is included in table format. Projects that have been terminated or had their work scope modified before the end of FY93 are noted. Over the past 30 months, six IDP-developed instruments have emerged as likely contributors to the ARM CART instrument suite. These include the Multi-Filter Rotating Shadowband Radiometer, the Atmospheric Emitted Radiance Interferometer, the Polarization Diversity Lidar, the Micro-Pulse Lidar, and the Cloud Profiling Radar System. Status of these instruments is summarized.

28350 (CONF-9303122–, pp. 267-273) **High spectral resolution fourier transform infrared instruments for the Atmospheric Radiation Measurement Program.** Revercomb, H.E. (Univ. of Wisconsin, Madison, WI (United States)); Smith, W.L.; Knuteson, R.O.; Best, F.A.; Dedecker, R.G.; Dirkx, T.P.; Herbsleb, R.A.; Short, J.F.; Howell, H.B.; Murcray, D. USDOE Office of Energy Research, Washington, DC (United States). Mar 1994. From 3. Atmospheric Radiation Measurement (ARM) science team meeting; Norman, OK (United States); 1-5 Mar 1993. In *Proceedings of the third Atmospheric Radiation Measurement (ARM) science team meeting.* 379p. Source: OSTI; NTIS; INIS.

Major accomplishments of the Atmospheric Emitted Radiance Interferometer (AERI) Instrument Development Program (IDP) effort have been to (1) develop and extensively test a new radiometric calibration subsystem with improved accuracy and robustness; (2) interact with Bomem, Inc., leading to the development of a two-channel interferometer with the required software characteristics; (3) develop new operational control software and network interfaces; (4) develop new analysis techniques to handle the complete calibration, including a detector nonlinearity correction, wavelength scale standardization, and a finite field-of-view correction; (5) integrate the required hardware, operational control software, and analysis software into a complete system which interfaces to the CART data system and operates remotely; and (6) perform extensive field testing of the AERI system prototype.

28351 (CONF-9303122–, pp. 275-281) **Development of rotating shadowband spectral radiometers and general circulation model radiation code test data sets in support of the Atmospheric Radiation Measurement Program.** Michalsky, J. (Univ. of Albany, NY (United States)); Harrison, L.; Beik, M.; Berkheiser, W. III; Schlemmer, J. USDOE Office of Energy Research, Washington, DC (United States). Mar 1994. From 3. Atmospheric Radiation Measurement (ARM) science team meeting; Norman, OK (United States); 1-5 Mar 1993. In *Proceedings of the third Atmospheric Radiation Measurement (ARM) science team meeting.* 379p. Source: OSTI; NTIS; INIS.

This program focuses in the development of spectral versions of the rotating shadowband radiometer (RSR). The RSR is a tool for the simultaneous measurement of total horizontal, diffuse horizontal, and direct normal irradiance. Besides instrument development and calibration activities, we are collecting a data set of high quality shortwave and longwave radiation measurements and meteorological variables from the Albany County airport, for use in testing radiation codes used in global climate models. In this paper we discuss the following main points: (1) the seven-channel multifilter rotating shadowband radiometer; (2) an objective algorithm for obtaining optical depths without the necessity of human intervention; (3) the cosine bench for measuring the cosine response functions of the RSRs and other radiometers; (4) rotating shadowband spectroradiometer progress; and (5) the effects of Mount Pinatubo on the aerosol above the Oklahoma-Kansas CART site.

28352 (CONF-9303122–, pp. 293-297) **Narrow-beam fast filter radiometry and the use of the lidar/radiometer method in the Atmospheric Radiation Measurement Program.** Platt, C.M.R. (CSIRO Division of Atmospheric Research, Aspendale (Australia)); Bennett, J.W.; Young, S.A.; Fenwick, M.D.; Manson, P.J.; Patterson, G.R.; Petraitis, B. USDOE Office of Energy Research, Washington, DC (United States). Mar 1994. From 3. Atmospheric Radiation Measurement (ARM) science team meeting; Norman, OK (United States); 1-5 Mar 1993. In *Proceedings of the third Atmospheric Radiation Measurement (ARM) science team meeting.* 379p. Source: OSTI; NTIS; INIS.

To characterize cloud properties in columns of atmosphere, two techniques have been developed, known collectively as the Lidar/Radiometer (LIRAD) method. The basis of the techniques is to use two independent groundbased observations of clouds. A laser radar measures the cloud height, structure and particle phase. A narrow-beam filter radiometer measures the cloud infrared (IR) radiance. By combining these observations with a radiosounding of temperature, accurate information on cloud infrared emittance can be obtained. If the cloud is semi-transparent, which is often the case for high cirrus ice clouds, then the cloud IR optical depth and profile of IR absorption coefficient can also be obtained. The secret of success in the technique is to use a radiometer with a narrow field-of-view compatible with that of the lidar and with a response time fast enough to follow the observed rapid fluctuations in cloud emission, which can often occur as different clouds come into view.

28353 (CONF-9303122–, pp. 303-306) **Laser remote sensing of water vapor: Raman lidar development.** Goldsmith, J.E.M. (Sandia National Laboratories, Livermore, CA (United States)); Lapp, M.; Bisson, S.E.; Melfi, S.H.; Whiteman, D.N.; Ferrare, R.A.; Evans, K.D. USDOE Office of Energy Research, Washington, DC (United States). Mar 1994. From 3. Atmospheric Radiation Measurement (ARM) science team meeting; Norman, OK (United States); 1-5 Mar 1993. In *Proceedings of the third Atmospheric Radiation Measurement (ARM) science team meeting.* 379p. Source: OSTI; NTIS; INIS.

The goal of this research is the development of a critical design for a Raman lidar system optimized to match ARM Program needs for profiling atmospheric water vapor at CART sites. This work has emphasized the development of enhanced daytime capabilities using Raman lidar techniques. This abstract touches briefly on the main components of the research program, summarizing results of the efforts. A detailed Raman lidar instrument model has been developed to predict the daytime and nighttime performance capabilities of Raman lidar systems. The model simulates key characteristics of the lidar system, using realistic atmospheric profiles, modeled background sky radiance, and lidar system parameters based on current instrument capabilities. The model is used to guide development of lidar systems based on both the solar-blind concept and the narrowband, narrow field-of-view concept for daytime optimization.

28354 (CONF-9303122–, pp. 307-311) **Cloud and aerosol characterization for the Atmospheric Radiation Measurement Central Facility: Multiple remote sensor techniques development.** Sassen, K. (Univ. of Utah, Salt Lake City, UT (United States)). USDOE Office of Energy Research, Washington, DC (United States). Mar 1994. From 3. Atmospheric Radiation Measurement (ARM) science team meeting; Norman, OK (United States); 1-5 Mar 1993. In *Proceedings of the third Atmospheric Radiation Measurement (ARM) science team meeting.* 379p. Source: OSTI; NTIS; INIS.

Previous studies have clearly indicated that only a varied combination of remote sensing instruments can provide the microphysical and radiative information for characterizing the cloudy atmosphere on an extended basis. We have taken an approach that specifies two levels of instrument observational capabilities. Using a basic combination of remote sensors, the first level provides for the measurement of the three-dimensional distribution of clouds and aerosols, including their boundaries, type, and phase. In addition to this fundamental characterization of the state of the cloudy atmosphere, the second level addresses more specific measurement categories, such as effective cloud particle size, to help provide fundamental radiative cloud quantities. This paper describes progress in the main research areas, specifically, polarization diversity lidar (PDL) development and cloud modeling and empirical studies.

28355 (CONF-9303122–, pp. 313-315) **Development of a dual-frequency, millimeter-wave cloud profiling radar system.** McIntosh, R.E. (Univ. of Massachusetts, Amherst, MA (United States)). USDOE Office of Energy Research, Washington, DC (United States). Mar 1994. From 3. Atmospheric Radiation Measurement (ARM) science team meeting; Norman, OK (United States); 1-5 Mar 1993. In *Proceedings of the third Atmospheric Radiation Measurement (ARM) science team meeting.* 379p. Source: OSTI; NTIS; INIS.

The Microwave Remote Sensing Laboratory (MIRSL) is developing a mobile, scanning millimeter-wave radar for the Atmospheric Radiation Measurement (ARM) Program. This project is intended to fill the void for instrumentation that can remotely measure the physical boundaries and phase of cloud particles in three dimensions. At present, there is no routine method for gathering such data. Imaging lidars cannot penetrate into thick cloud cover; thus, they give limited vertical information about clouds. In situ measurements from aircraft can provide accurate microphysical data, but aircraft are expensive to operate and the measurements cover only

a limited region of the sky. A ground-based radar is the only practical way to routinely provide three-dimensional characterizations of cloud properties on the scale and in the detail required for ARM. In this paper, we show preliminary data, which demonstrate that polarimetric millimeter-wave radars can distinguish cloud water droplets from ice particles. We also describe the ground-based Cloud Profiling Radar System (CPRS), which will be able to simultaneously obtain three-dimensional images of the polarimetric response of clouds at 33 and 95 GHz (9 and 3.2 mm). This system should be complete and ready to participate in an intensive operation period (IOP) planned for June 1993.

28356 (CONF-9303122–, pp. 317-322) **Implementation of instrumentations and facilities at the Southern Great Plains Cloud and Radiation Testbed Site.** Sisterson, D.L. (Argonne National Laboratory, IL (United States)); Wesely, M.L. USDOE Office of Energy Research, Washington, DC (United States). Mar 1994. From 3. Atmospheric Radiation Measurement (ARM) science team meeting; Norman, OK (United States); 1-5 Mar 1993. In *Proceedings of the third Atmospheric Radiation Measurement (ARM) science team meeting.* 379p. Source: OSTI; NTIS; INIS.

Considerable progress has been made in installing instruments and trailers at the Southern Great Plains (SGP) Clouds and Radiation Testbed (CART) site. While initial activity concentrated on the central facility, planning proceeded for installation of extended facilities, which will begin operations in 1993. To reduce the number of problems associated with installing and operating instruments at the SGP CART site, a number of procedures were developed for CART instruments, Instrument Development Program (IDP) systems, and instruments of opportunity. A key role is held by the on-site instrument coordinator, who conducts a checklist review before an instrument is brought to the site. The purpose of the checklist is to identify installation and operational requirements of the instrument. When the checklist is sufficiently complete, an operational readiness review is conducted by site operations. On the basis of the number and severity of the deficiencies, site operations either accepts the instrument, does not accept the instrument but operates it in a degraded mode until problems are fixed, or does not operate the instrument. Similar procedures are followed for other types of equipment and some aspects of the site data system.

28357 (CONF-9303122–, pp. 343-344) **Unmanned aerospace vehicle system concept.** Bolten, W.R. (Sandia National Laboratories, Livermore, CA (United States)). USDOE Office of Energy Research, Washington, DC (United States). Mar 1994. From 3. Atmospheric Radiation Measurement (ARM) science team meeting; Norman, OK (United States); 1-5 Mar 1993. In *Proceedings of the third Atmospheric Radiation Measurement (ARM) science team meeting.* 379p. Source: OSTI; NTIS; INIS.

The ARM/Unmanned Aerospace Vehicle (ARM/UAV) provides airborne measurement capability for CART sites which will complement piloted aircraft and supplement the capabilities of ground-based CART instruments. The first development phase is the UAV demonstration flight (UDF) series which will measure radiative flux divergence. In addition to the scientific objectives, UDF has programmatic objectives which include obtaining operational experience with UAVs and addressing airspace and safety approval issues that must be resolved for later phases of the program.

28358 (CONF-9303122–, pp. 345-346) **The atmospheric radiation measurement unmanned aerospace vehicle program: An overview.** Crowley, P.A. (Department of Energy, Washington, DC (United States)); Vitko, J. Jr. USDOE Office of Energy Research, Washington, DC (United States). Mar 1994. From 3. Atmospheric Radiation Measurement (ARM) science team meeting; Norman, OK (United States); 1-5 Mar 1993. In *Proceedings of the third Atmospheric Radiation Measurement (ARM) science team meeting.* 379p. Source: OSTI; NTIS; INIS.

This paper describes the start-up of the ARM-Unmanned Aerospace Vehicle (UAV) program. Based on the need to fly above the tropopause for multiple diurnal cycles and at a sufficiently low cost to permit sustained coverage, DOE proposed and has now obtained initial funding for the ARM-UAV program. To ensure a smooth and efficient startup, an Interim Science Team (IST) has been formed to provide initial scientific guidance. The IST identified two broad classes of mission for ARM/UAV: Quasi-continuous missions which emphasize consistent long-term observations of key radiation-cloud parameters as part of a continuous ARM data stream; and Investigative missions which change with time and focus on testing specific hypotheses. These missions will be accomplished in phases, starting with a demonstration phase then moving through an interim capability and on the a full capability operation.

28359 (CONF-9303122–, pp. 347-348) **Strawman payload for the unmanned aerospace vehicle demonstration flights.** Vitko, J. Jr. (Sandia National Laboratories, Livermore, CA (United States)). USDOE Office of Energy Research, Washington, DC (United States). Mar 1994. From 3. Atmospheric Radiation Measurement (ARM) science team meeting; Norman, OK (United States); 1-5 Mar 1993. In *Proceedings of the third Atmospheric Radiation Measurement (ARM) science team meeting.* 379p. Source: OSTI; NTIS; INIS.

The first phase of the Atmospheric Radiation Measurement-Unmanned Aerospace Vehicle (ARM-UAV) program is a demonstration phase meant to provide both scientific results and operational experience within the first year of the program. These UAV demonstration flights (UDF) will emphasize flux divergence measurements, a key building block in the longer term goals of ARM-UAV. The basic idea is to make up- and down-looking broadband flux measurements from a UAC and combine these with similar measurements made from the ground, other aircraft/UAVs, and satellites to obtain the flux divergence. Of necessity, the UDF will use "existing" equipment - both in terms of instrumentation and UAVs. A strawman UAV payload for this mission is heuristically shown. This payload consists of three main groupings of instruments: small, accurate, flux radiometers which provide the critical flux measurements; an ancillary package which provides spectral radiances and visible imagery to aid in the interpretation of the flux divergence; and a meteorological package which characterizes the bulk state of the atmosphere. Selected portions of this payload are described briefly below.

28360 (KCP–613-5368) **Establishing a low-power fiber optic cable facility: Final report.** Belarde, E. Allied-Signal Aerospace Co., Kansas City, MO (United States). Kansas City Div. May 1994. 12p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00613. Order Number DE94015865. Source: OSTI; NTIS; GPO Dep.

The capability for the manufacture of fiber optic cables for low-energy applications was established at AlliedSignal Inc., Kansas City Division. The processes for mounting the most common optic connectors were developed and characterized.

28361 (LA-UR–94-1310) **Optical wheel-rotation sensor.** Veeser, L. (Los Alamos National Lab., NM (United States)); Rodriguez, P.; Forman, P.; Deeter, M. Los Alamos National Lab., NM (United States). [1994]. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-9410103–2: 10. optical fibre sensors conference, Glasgow (United Kingdom), 11-13 Oct 1994). Order Number DE94011719. Source: OSTI; NTIS; GPO Dep.

We describe a fiber-optic rotation sensor based on diffraction of light in a magneto-optic crystal (BIG). Exploitation of this effect permits the construction of a sensor requiring no polarization elements or lenses.

28362 (LA-UR–94-2562) **Characterization of multiport solid state imagers at megahertz data rates.** Yates, G.J.; Pena, C.R.; Turko, B.T. Los Alamos National Lab., NM (United States). [1994]. 10p. Sponsored by Department of Defense, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-940723–8: Annual meeting of the Society of Photo-Optical Instrumentation Engineers, San Diego, CA (United States), 24-29 Jul 1994). Order Number DE94016095. Source: OSTI; NTIS; GPO Dep.

Test results obtained from two recently developed multiport Charge-Coupled Devices (CCDs) operated at pixel rates in the 10-to-100 MHz range will be presented . The CCDs were evaluated in Los Alamos National Laboratory's High Speed Solid State Imager Test Station (HSTS) which features PC-based programmable clock waveform generation (Tektronix DAS 9200) and synchronously

clocked Digital Sampling Oscilloscopes (DSOs) (LeCroy 9424/9314 series) for CCD pixel data acquisition, analysis and storage. The HSTS also provided special designed optical pinhole array test patterns in the 5-to-50 micron diameter range for use with Xenon Strobe and pulsed laser light sources to simultaneously provide multiple single-pixel illumination patterns to study CCD point-spread-function (PSF) and pixel smear characteristics. The two CCDs tested, EEV model CCD-13 and EG&G Reticon model HSO512J, are both 512 x 512 pixel arrays with eight (8) and sixteen (16) video output ports respectively. Both devices are generically Frame Transfer CCDs (FT CCDs) designed for parallel bi-directional vertical readout to augment their multiport design for increased pixel rates over common single port serial readout architecture. Although both CCDs were tested similarly, differences in their designs precluded normalization or any direct comparisons of test results. Rate dependent parameters investigated include S/N, PSF, and MTF. The performance observed for the two imagers at various pixel rates from selected typical output ports is discussed.

28363 Traveling-wave photodetector. Hietala, V.M.; Vawter, G.A. To Dept. of Energy. 1992. Filed date 15 Jun 1992. U.S. Patent Application 7-898,999. 22p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. Order Number DE94014887. Source: OSTI; NTIS; GPO Dep.

The traveling-wave photodetector of the present invention combines an absorptive optical waveguide and an electrical transmission line, in which optical absorption in the waveguide results in a photocurrent at the electrodes of the electrical transmission line. The optical waveguide and electrical transmission line of the electrically distributed traveling-wave photodetector are designed to achieve matched velocities between the light in the optical waveguide and electrical signal generated on the transmission line. This velocity synchronization provides the traveling-wave photodetector with a large electrical bandwidth and a high quantum efficiency, because of the effective extended volume for optical absorption. The traveling-wave photodetector also provides large power dissipation, because of its large physical size.

28364 Non-linear optical crystal vibration sensing device. Kalibjian, R. To Dept. of Energy. 1992. Filed date 19 Jun 1992. U.S. Patent Application 7-901,289. 19p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. Order Number DE94014886. Source: OSTI; NTIS; GPO Dep.

The report describes a non-linear optical crystal vibration sensing device including a photorefractive crystal and a laser. The laser produces a coherent light beam which is split by a beam splitter into a first laser beam and a second laser beam. After passing through the crystal the first laser beam is counter-propagated back upon itself by a retro-mirror, creating a third laser beam . The laser beams are modulated, due to the mixing effect within the crystal by vibration of the crystal. In the third laser beam modulation is stable and such modulation is converted by a photodetector into a usable electrical output, intensity modulated in accordance with vibration applied to the crystal.

28365 Enhanced radiation resistant fiber optics. Lyons, P.B.; Looney, L.D. To Dept. of Energy. 1992. Filed date 3 Sep 1992. U.S. Patent Application 7-940,409. 16p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. Order Number DE94016104. Source: OSTI; NTIS; GPO Dep.

A process for producing an optical fiber having enhanced radiation resitance is provided, the process including maintaining an optical fiber within a hydrogen-containing atmosphere for sufficient time to yield a hydrogen-permeated optical fiber having an elevated internal hydrogen concentration, and irradiating the hydrogen-permeated optical fiber at a time while the optical fiber has an elevated internal hydrogen concentration with a source of ionizing radiation. The radiation source is typically a cobalt-60 source and the fiber is pre-irradiated with a dose level up to about 1000 kilorads of radiation.

28366 (UCRL-JC–117434) **What those defects in optical coatings really look like.** Tench, R.J.; Chow, R.; Kozlowski, M.R. Lawrence Livermore National Lab., CA (United States). May 1994. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-9405139–3: 1994 international American Vacuum Society users conference, Boston, MA (United States), 2-13 May 1994). Order Number DE94015324. Source: OSTI; NTIS; GPO Dep.

Laser-induced damage in optical coatings is generally associated with micrometer-scale defects. A simple geometric model for nodule-shaped defects is commonly used to describe defects in optical coatings. No systematic study has been done, however, to prove the applicability of that model to standard optical coating deposition. Some defects are known not to have a classic nodule geometry. The present study uses atomic force microscopy (AFM) and scanning electron microscopy to characterize the topography of coating defects in a HfO_2/SiO_2 multilayer mirror system. Focused ion-beam cross-sectioning is then used to study the underlying defect structure. This work develops a model for defect shape such that the overall geometry of a coating defect, particularly seed size and depth, can be inferred from non-destructive evaluation measurements such as AFM. The relative mechanical stabilities of nodular defects can be deduced based on the nodule's geometry. Auger analysis showed that the seed material that causes nodular defects in HfO_2/SiO_2 multilayers is a hafnia oxide. Such characterization capabilities are needed for understanding the enhanced susceptibility of particular defects to laser damage and for developing improved techniques for depositing low-defect density coatings.

4407 Geophysical and Meteorological Instrumentation

Refer also to citation(s) 28348, 28349, 28351, 28355, 28356, 28357, 28358, 28457

28367 (CONF-9303122–, pp. 97-100) **System design and implementation of the integrated sounding system.** Martin, C.L. (National Center for Atmospheric Research, Boulder, CO (United States)); Barrett, A.L. USDOE Office of Energy Research, Washington, DC (United States). Mar 1994. From 3. Atmospheric Radiation Measurement (ARM) science team meeting; Norman, OK (United States); 1-5 Mar 1993. In *Proceedings of the third Atmospheric Radiation Measurement (ARM) science team meeting.* 379p. Source: OSTI; NTIS; INIS.

The integrated sounding system (ISS) combines a suite of in situ and remote sensing systems with local computing capabilities. The resulting integrated instrument provides detailed real-time vertical profiles of the basic atmospheric parameters at a variety of time and space resolutions. One hallmark of the system is its configurability, which allows individual sensing systems to be added or removed as needed. A flexible data system copes easily with evolving and changing observation formats and requirements. A typical ISS configuration might include a wind profiler, a radio acoustic sounding system, a navaid based radiosonde, and a surface meterological station. Individual observing platforms in an ISS operate in a stand-alone mode and communicate via a common network to deliver high-level data products to the central workstation. The observing platforms often support archival of low-level data. Allowing the subsystems to operate independently prevents a fault in one system from affecting the others, and the low-level archives provide data redundancy.

28368 (CONF-9303122–, pp. 283-286) **Development of a balloon-borne stabilized platform for measuring radiative flux profiles in the atmospheric boundary layer.** Whiteman, C.D. (Pacific Northwest Laboratory, Richland, WA (United States)); Alzheimer, J.M.; Anderson, G.A.; Shaw, W.J. USDOE Office of Energy Research, Washington, DC (United States). Mar 1994. DOE Contract AC06-76RL01830. From 3. Atmospheric Radiation Measurement (ARM) science team meeting; Norman, OK (United States); 1-5 Mar 1993. In *Proceedings of the third Atmospheric Radiation Measurement (ARM) science team meeting.* 379p. Source: OSTI; NTIS; INIS.

A stabilized platform, called the Sky Platform has been developed to carry broadband short-wave and long-wave radiometric sensors on the tether line of a small tethered balloon that ascends through atmospheric depths of up to 1.5 km. The resulting vertical profiles of radiative flux and flux divergence should prove useful in evaluating atmospheric radiative transfer models, especially for cloudy conditions where the radiative transfer codes are in an early state

of development. This paper presents field performance tests of the stabilization system on the Sky Platform. Initial tests show that it is effectively stabilized to an average tilt angle of less than 1 degree with standard deviations of less than 2 degrees under wintertime conditions with moderate shear in a 200-m-deep well-mixed boundary layer. The Motion-Sensing Platform appears to be capable of characterizing the dynamics of the balloon-Sky Platform tether-line system and should be able to provide the information necessary to improve the control loop stabilization system on the Sky Platform.

28369 (CONF-9303122–, pp. 291) **Accuracy of net radiation profiles from a self-leveling balloon-borne platform.** Shaw, W.J. (Pacific Northwest Laboratory, Richland, WA (United States)); Whiteman, C.D. USDOE Office of Energy Research, Washington, DC (United States). Mar 1994. DOE Contract AC06-76RL01830. From 3. Atmospheric Radiation Measurement (ARM) science team meeting; Norman, OK (United States); 1-5 Mar 1993. In *Proceedings of the third Atmospheric Radiation Measurement (ARM) science team meeting.* 379p. Source: OSTI; NTIS; INIS.

Net radiation profiles near the earth's surface provide the means to assess the importance of radiative heating in the lower atmosphere and the effectiveness of lower atmospheric radiation parameterizations in global climate models. A self-leveling platform has been developed that carries short- and long-wave radiometers aloft using a tethered balloon. While the leveling mechanism is effective, it is not perfect. This poster describes tests of a model used to establish the likely errors from residual platform motion. The model uses a standard numerical integration scheme to calculate the irradiance measured by an ideal but tipped sensor in an arbitrary radiance field. The model is useful both for determining the degree to which platform motion must be stabilized to reduce measurement errors to acceptable levels and for calculating errors due to actual platform motion.

4408 Miscellaneous Instrumentation

Refer also to citation(s) 27793, 28399, 28776

28370 (DOE/CE/15566–T3) **A charge distribution analysis instrument for catalysis and material science applications: Third quarterly technical progress report, April 1, 1994–June 30, 1994.** Freund, F. Phytron Instruments, Inc., Mountain View, CA (United States). 5 Aug 1994. 15p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG49-93CE15566. Order Number DE94016489. Source: OSTI; NTIS; GPO Dep.

Key component in the CDA instrument is the differential capacitive force sensor. The CDA instrument has four basic components: OEM analytical balance, flexure point and capacitor plates, gas confinement tower and high-voltage bias electrodes, and the furnace. Phyton is in position to purchase an OEM analytical balance; negotations are underway for obtaining the feedback control circuitry for the differential capacitive force sensor. Progress with the differential capacitive force sensor is reviewed.

28371 (DOE/ER/13811–6) **Theoretical studies of hydrocarbon combustion chemistry: Annual progress report.** Schaefer, H.F. III. Georgia Univ., Athens, GA (United States). Research Foundation. [1994]. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG09-87ER13811. Order Number DE94017155. Source: OSTI; NTIS; GPO Dep.

The author reports here the results of DZP CISD calculations for methylcarbene. Geometry, symmetry, and vibrational modes for the radical are reported for both the singlet and the triplet state. Future work will focus on the ethyl radical-oxygen interaction relevant to hydrocarbon combustion.

28372 **Optical voltage reference.** Rankin, R.; Kotter, D. To Dept. of Energy. 1992. Filed date 9 Sep 1992. U.S. Patent Application 7-942,239. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-84ID12435. Order Number DE94016101. Source: OSTI; NTIS; INIS; GPO Dep.

An optical voltage reference for providing an alternative to a battery source. The optical reference apparatus provides a temperature stable, high precision, isolated voltage reference through the use of optical isolation techniques to eliminate current and impedance coupling errors. Pulse rate frequency modulation is employed to eliminate errors in the optical transmission link while phase-lock feedback is employed to stabilize the frequency to voltage transfer function.

28373 (UCRL-CR–118201) **Micro-ultraviolet spectrograph (Micro-UVS): Final design report.** Stern, S.A. (Southwest Research Institute, San Antonio, TX (United States). Space Science Dept.); Slater, D.C. Lawrence Livermore National Lab., CA (United States). 30 Apr 1994. 33p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. Order Number DE94016704. Source: OSTI; NTIS; GPO Dep.

In this report, the authors present a low-mass (<2 kg), low-power (approximately 2 W), and low-cost (< $0.5M) Far UV spectrometer design, capable of performing high-resolution ($\lambda/\delta\lambda$ approximately equal to 100-200) spectroscopy of planetary atmospheres in the extreme ultraviolet wavelength regime (700 Å < λ < 1500 Å). This spectrograph, referred to in this report as the MicroUVS, is in part based on the integrated UV/VIS/IR Pluto Fast Flyby (PFF) design being developed for NASA, but is tailored to be a stand-alone instrument suitable for future BMDO/LLNL missions. Design objectives and performance of the spectrometer are discussed in detail.

28374 (UCRL-JC–117191) **Subsurface object position and image correction for standoff Ground Penetrating Radar.** Kane, R.J. Lawrence Livermore National Lab., CA (United States). May 1994. 16p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-9405159–3: Unexploded ordnance detection and range-remediation conference, Golden, CO (United States), 17-19 May 1994). Order Number DE94015180. Source: OSTI; NTIS; GPO Dep.

Present applications of standoff (airborne) Ground Penetrating SAR (Synthetic Aperture Radar) allows objects near the surface to be detected but only provides an approximation for the actual location and image. When single media models are employed the lack of correction for the phase velocity and refractive changes at the air/soil interface result in object distortions. Positional errors and image distortions comparable to the size of the object are possible. Correction is possible, if the media properties are known, by modeling the scene as a two-layer medium and accounting for the propagation effects. The propagation parameters for the lower media are estimated in the migration of observable responses for surface and subsurface objects. This approach allows for corrected images to subsurface objects to be produced after data collection. Surface objects will be distorted as a result of this process. The modeling process, simulations, and results with field data will be discussed. An improvement by a factor of two would enable standoff radar to detect objects at depths of on meter or more benefiting Unexploded Ordnance (UXO) and hazardous waste site survey activities.

45 MILITARY TECHNOLOGY, WEAPONRY, AND NATIONAL DEFENSE

28375 (ANL/TD/CP–81967) **Key research issues in the pulsed fast-neutron analysis technique for cargo inspection.** Micklich, B.J.; Fink, C.L.; Yule, T.J. Argonne National Lab., IL (United States). [1994]. 12p. Sponsored by Executive Office of the President, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-940723–6: Annual meeting of the Society of Photo-Optical Instrumentation Engineers, San Diego, CA (United States), 24-29 Jul 1994). Order Number DE94015081. Source: OSTI; NTIS; GPO Dep.

Non-invasive inspection systems based on the use of fast neutrons are being studied for the inspection of large cargo containers. A key advantage of fast neutrons is their sensitivity to low-Z elements such as carbon, nitrogen, and oxygen, which are the primary constituents of explosives and narcotics. The high energy allows penetration of relatively large containers. The pulsed fast-neutron analysis (PFNA) technique is currently the baseline system. A workshop on the PFNA technique involving industrial, government, and university participants was held at Argonne National Lab. in January 1994. The purpose of this workshop was to review the status of research on the key technical issues involved

in PFNA, and to develop a list of those areas where additional modeling and/or experimentation were needed. The workshop also focused on development of a near-term experimental assessment program using existing prototypes and on development of a long-term test program at the Tacoma Testbed, where a PFNA prototype will be installed in 1995. A summary of conclusions reached at this workshop is presented. Results from analytic and Monte Carlo modeling of simplified PFNA systems are also presented.

28376 (LA-SUB–93-195) **Wide band receiver technology study for the Lightweight Attack Reporting System (LARS).** Pearson, D.M. (Syndetix, Inc., Las Cruces, NM (United States)); Merewether, E.; Ham, C. Los Alamos National Lab., NM (United States); Syndetix, Inc., Las Cruces, NM (United States). Jan 1993. 91p. Sponsored by Department of Defense, Washington, DC (United States). DOE Contract W-7405-ENG-36. (LA–1-93-013). Order Number DE94015426. Source: OSTI; NTIS (US Sales Only); GPO Dep.

An investigation was performed to estimate the state of the art in wideband receiver technology suitable for a threat warning and attack reporting system for small to medium-sized satellites. The requirements for such a system and candidate receiver approaches were identified and evaluated. The operating principles and characteristics of each approach were presented. Critical technologies that limited each technique were identified and the state of these technologies estimated. The candidate approaches were evaluated in terms of ability to fulfill the mission. A recommendation for further work was made.

28377 (LA-SUB–94-98) **[Direct support of the STOW effort and SAFAGANZA experiments]: Final report, February–14 March 1994.** Kollmorgen, L.S. (TLK, Inc., Nellysford, VA (United States)). Los Alamos National Lab., NM (United States); TLK, Inc., Nellysford, VA (United States). 24 Mar 1994. 8p. Sponsored by Department of Defense, Washington, DC (United States). DOE Contract W-7405-ENG-36. Order Number DE94016572. Source: OSTI; NTIS; GPO Dep.

The Synthetic Theater of War program, under the leadership of the Advanced Distributed Simulation Office, was redesignated a probationary Advanced Concept Technology Demonstration by the Office of the Secretary of Defense. This new designation makes the STOW program, and the enabling technology developments, one of only six major technology thrusts being supported by the Defense Research and Development organization. Support to this technology area, has been, and will continue to be a major thrust for this contract and the follow-on contract. Over the extended period of this contract we have supported a major experimental series, the Counter Target Acquistion System (CTAS), and initiated support and development effort for STOW-97 and participated in ongoing series of experiments known as the SAFAGANZA. These efforts have seen the development of significant experiment support and analysis tools, i.e. the integration of headeye tracking to manned tactical simulation and the Simulyzer analysis system. Recently, we have initiated the development of a customized data base analysis tool to enable analysis supporting selection of communications bandwidth reduction designs and concepts. This is in direct support of the STOW effort and intrinsic to the SAFAGANZA experiments.

28378 (LA-UR–94-1434) **Synoptic comparison of major US and UK simulations.** Henderson, D.B.; Oxenham, D. Los Alamos National Lab., NM (United States). [1994]. 51p. Sponsored by Department of Defense, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-9406196–1-VUGRAPHS: 7. multinational TMD conference, Annapollis, MD (United States), 21-24 Jun 1994). Order Number DE94014719. Source: OSTI; NTIS; GPO Dep.

The six simulations considered include two from the United Kingdom: The United Kingdom Extended Air Defence Test Bed (UKEADTB) and the Air Defence Test Bed (ADTB). There are two from the Test Bed Product Office of the US Army Space and Strategic Defense Command (USASSDC) in Huntsville, Alabama: The Extended Air Defense Test Bed (EADTB) and the Extended Air Defense Simulation (EADSIM). There are two from the National Test Facility in Colorado Springs, Colorado: The Test Planning Tool (TPT) and the Human in Control Test Bed (HICTB). A seventh, the Brilliant Eyes Simulator (BESim) – an element simulation and a close family member of the system level TPT – is included along with TPT by noting exceptions where necessary. The comparisons are designed to be compact and comprehensible, with no table occupying more than a single page. The present report is organized with the tables on the odd numbered pages and some commentary on the facing even numbered pages. While the effort reported is extensive, it needs to be further developed as planned as the Subpanel's next major undertaking. Analogously with simulations themselves, there remains the question of validation or accreditation. Also analogously, these depend upon the question being served. That is, the responses reported here, while extensive and interesting, need to be explicitly reviewed in the light of any given serious application. Unfortunately, and again analogously with simulations, this accreditation can not be done in the abstract or once and for all.

4501 Chemical Explosions and Explosives

Refer also to citation(s) 27912, 28373, 28400, 28493, 28522

28379 (SAND–94-1614C) **Comments on TNT Equivalence.** Cooper, P.W. Sandia National Labs., Albuquerque, NM (United States). [1994]. 12p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. (CONF-940776–6: 20. international pyrotechnics seminar, Colorado Springs, CO (United States), 25-29 Jul 1994). Order Number DE94015279. Source: OSTI; NTIS; GPO Dep.

The term "TNT Equivalence" is used throughout the explosives and related industries to compare the effects of the output of a given explosive to that of TNT. This is done for technical design reasons in scaling calculation such as for the prediction of blast waves, craters, and structural response, and is also used as a basis for government regulations controlling the shipping, handling and storage of explosive materials, as well as for the siting and design of explosive facilities. TNT equivalence is determined experimentally by several different types of tests, the most common of which include: plate dent, ballistic mortar, trauzl, sand crush, and air blast. All of these tests do not necessarily measure the same output property of the sample explosive. As examples of this, some tests depend simply upon the CJ pressure, some depend upon the PV work in the CJ zone and in the Taylor wave behind the CJ plane, some are functions of the total work which includes that from secondary combustion in the air mixing region of the fireball and are acutely effected by the shape of the pressure-time profile of the wave. Some of the tests incorporate systematic errors which are not readily apparent, and which have a profound effect upon skewing the resultant data. Further, some of the tests produce different TNT Equivalents for the same explosive which are a function of the conditions at which the test is run. This paper describes the various tests used, discusses the results of each test and makes detailed commentary on what the test is actually measuring, how the results may be interpreted, and if and how these results can be predicted by first principals based calculations. Extensive data bases are referred to throughout the paper and used in examples for each point in the commentaries.

28380 (SAND–94-8616C) **Demilitarization and treatment of energetic materials and componentry.** Stoddard, M.C.; LaJeunesse, C.A.; Rice, S.F.; Mills, B.E.; Replogle, W.C.; Blankenship, D.M. Sandia National Labs., Albuquerque, NM (United States). [1994]. 2p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. (CONF-9405136–14: 1994 joint USA-Russia energetic material technology symposium, Livermore, CA (United States), 18-25 May 1994). Order Number DE94015892. Source: OSTI; NTIS; GPO Dep.

Short communication. CHEMICAL EXPLOSIVES/waste processing; ORDNANCE/waste processing; SUPERCRITICAL STATE; OXIDATION; PLASMA FURNACES; COMBUSTION; PYROLYSIS; ORDNANCE

28381 (UCRL-ID–117250) **Base hydrolysis of HMX/DMSO solutions.** Pagoria, P.F. Lawrence Livermore National Lab., CA (United States). 15 Mar 1994. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. Order Number DE94016008. Source: OSTI; NTIS; GPO Dep.

The authors investigated the decomposition of HMX or PBX-9404 as a 25% solution in DMSO by treatment with aqueous base solutions. They investigated investigated two concentrations of NaOH solutions, 40% NaOH and 2N NaOH. ^{1}H-nmr spectroscopy was chosen to follow the decomposition by ^{1}H-nmr spectroscopy, watching the disappearance of the -CH_2-absorbance of HMX at 6.2 ppm. The 40% NaOH solution is initially immiscible with the DMSO solution but becomes miscible as it reacts. The reaction is exothermic with recorded temperatures after mixing reaching 90°C. The mixture does foam somewhat but this can be controlled by slowing down the stirring speed. The 2N NaOH solution is miscible with the HMX/DMSO solution but upon mixing the HMX is precipitated by the water present in the base solution. The mixing of the solutions is much less exothermic and the decomposition is slower than the 40% NaOH solution so the mixture is heated at 60°C for 1h to facilitate the decomposition.

28382 (UCRL-ID–117549) **LLNL demonstration of liquid gun propellant destruction in a 0.1 gallon per minute scale reactor.** Cena, R.J.; Thorsness, C.B.; Coburn, T.T.; Watkins, B.E. Lawrence Livermore National Lab., CA (United States). 1 Jun 1994. 17p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. Order Number DE94016012. Source: OSTI; NTIS; GPO Dep.

The Lawrence Livermore National Laboratory (LLNL) has built and operated a pilot plant for processing oil shale using recirculating hot solids. This pilot plant, was adapted in 1993 to demonstrate the feasibility of decomposing a liquid gun propellant (LGP), LP XM46, a mixture of 76% HAN (NH_3OHNO_3) and 24% TEAN $(HOCH_2CH_2)_3$ $NHNO_3$ diluted 1:3 in water. In the Livermore process, the LPG is thermally treated in a moving packed bed of ceramic spheres, where TEAN and HAN decompose, forming a suite of gases including: methane, carbon monoxide, oxygen, nitrogen oxides, ammonia and molecular nitrogen. The ceramic spheres are circulated and heated, providing the energy required for thermal decomposition. The authors performed an extended one day (8 hour) test of the solids recirculation system, with continuous injection of approximately 0.1 gal/min of LGP, diluted 1:3 in water, for a period of eight hours. The apparatus operated smoothly over the course of the eight hour run during which 144 kg of solution was processed, containing 36 kg of LGP. Continuous on-line gas analysis was invaluable in tracking the progress of the experiment and quantifying the decomposition products. The reactor was operated in two modes, a "Pyrolysis" mode, where decomposition products were removed from the moving bed reactor exit, passing through condensers to a flare, and in a "Combustion" mode, where the products were oxidized in air lift pipe prior to exiting the system. In the "Pyrolysis" mode, driver gases were recycled producing a small, concentrated stream of decomposition products. In the "Combustion mode", the driver gases were not recycled, resulting in 40 times higher gas flow rates and correspondingly lower concentrations of nitrogen bearing gases.

28383 (UCRL-ID–117583) **Detonability of DMSO/LX-10-1 and DMSO/PBX-9404 solutions.** Helm, F.; Hoffman, D.M. Lawrence Livermore National Lab., CA (United States). 29 Jun 1994. 27p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. Order Number DE94016482. Source: OSTI; NTIS; GPO Dep.

Although Lawrence Livermore National Laboratory has been involved in weapons disassembly since its involvement in weapons design, the Lab was recently requested by the Department of Energy to extend its responsibility for LLNL-designed weapons to include dismantlement of some systems in the cold war arsenal. Dissolution of LX-10-1 and PBX-9404 explosive from two artillery fired atomic projectiles (AFAPs) can be accomplished using dimethyl sulfoxide. The composition of LX-10-1 and PBX-9404 are given. The authors have evaluated the detonability of solutions of these two plastic bonded explosives in dimethyl sulfoxide (DMSO) under shock and thermal scenarios based on the UN "Recommendations on the Transport of Dangerous Goods - Tests and Criteria" (ST/SG/AC.10/11) and US Army Technical Bulletin 700-2. Prior to the relatively large scale shock and thermal sensitivity testing, small scale safety tests and thermochemical code calculations were used as a preliminary estimate of the detonability and hazards associated with up to 33% of these explosives in DMSO. Thermochemical calculations, small scale safety testing, and gap testing all indicate that these solutions are not detonable. They are currently in the process of evaluating these solutions using the small scale cookoff bomb (SCB) test.

28384 (UCRL-ID–117787) **Quantic Industries Inc. slapper detonator performance.** Cutting, J.L.; Lee, R.S.; Hodgin, R.L. Lawrence Livermore National Lab., CA (United States). May 1994. 12p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. Order Number DE94016486. Source: OSTI; NTIS; GPO Dep.

Under the Lawrence Livermore National Laboratories (LLNL) Small Business Technology Transfer Program, assistance was given to Quantic Industries Inc. to use the High Explosive Applications Facility (HEAF), its apparatus, and LLNL expertise to characterize the performance of Quantic's micro-clad copper/kapton slapper detonator assemblies and establish their threshold to detonate HNS-IV. The project involved measuring the performance of these slapper detonators, otherwise known as Exploding Foil Initiators (EFI's), manufactured by Quantic Industries Inc. Slapper performance was measured by using a laser velocimeter, which is an expensive and specialized facility which Quantic does not own. The authors measured slapper velocity vs. time as a function of charging voltage. Quantic supplied slappers which were coated with ~100 nm of Al to provide a reflective surface for the laser velocimeter measurements. LLNL provided to a capacitor discharge unit (CDU) to fire the slappers and matched the Quantic CDU waveforms as close as possible.

4502 Nuclear Explosions and Explosives

Refer also to citation(s) 27297, 27532, 27533, 27534, 27553, 27561, 28391, 28392, 28393, 28460, 28471, 28475, 28485

28385 (DOE/NV–365) **United States Department of Energy, Nevada Operations Office, completion report Operation KLAXON, Fiscal Year 1993.** USDOE Nevada Operations Office, Las Vegas, NV (United States). Jun 1994. 170p. Sponsored by USDOE, Washington, DC (United States). Order Number DE94016712. Source: OSTI; NTIS; INIS; GPO Dep.

The U.S. Department of Energy, Nevada Operations Office (DOE/NV), Completion Report provides a summary of activities conducted at the Nevada Test Site (NTS) between October 1, 1992, and September 30, 1993, associated with Operation KLAXON. (In the past, each annual Completion Report dealt with a series of underground nuclear detonations; however, because no nuclear tests were conducted during FY 1993, this Report summarizes continuing nonnuclear and nuclear test readiness activities at the NTS sponsored by DOE/NV.) The report serves as a reference for those involved with the planning and execution of Operation KLAXON and also serves as a planning guide for future operations. Information in the report covers the logistics and management of activities. Scientific information and data associated with NTS activities are presented in technical documents published by participating agencies. In September 1992, Congress legislated a nine-month moratorium on the testing of nuclear weapons. The bill also provided for a resumption of testing (with no more than five tests per year, or a total of 15 during the next three years) in July 1993, and mandated an end to nuclear testing, entirely, by 1996. President Bush signed the bill into law in October 1992.

28386 (EGG–1183-1262) **Surveillance photography: Technical memorandum L-164.** Donovan, L. EG and G Energy Measurements, Inc., Las Vegas, NV (United States). 25 Aug 1966. 23p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC08-76NV01183. Order Number DE94015388. Source: OSTI; NTIS; GPO Dep.

The surveillance photography of underground nuclear detonations at NTS was engineered by EG&G to furnish the following information on unexpected venting: (1) establish when, with respect to zero time, the venting occurred; (2) record the point or points of emission of the venting gases; (3) show the colors, if any, of the venting gases; (4) the direction of cloud travel; and (5)

dimensions and volume of the cloud as a function of time. In addition, the film records provide a color documentary film including a record of gross surface motion and a record of unexpected surface phenomenon (such as in Longshot). Surveillance coverage starts at minus 5 seconds and continues to plus 30 minutes. This report describes the typical photographic program setup, films used, and film processing.

28387 (EGG-ME–11131) **Eaton Throat-Valve Element prototype concept: Phase 1.** Stacey, M.R.; Arendts, J.G.; Berry, R.A.; Korth, G.E.; Schwieder, P.R.; Sekot, J.P.; Snow, S.D. EG and G Idaho, Inc., Idaho Falls, ID (United States). Dec 1993. 225p. Sponsored by Department of Defense, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE94015291. Source: OSTI; NTIS; GPO Dep.

As part of an ongoing effort to improve techniques for simulating nuclear blasts, the US Army Research Laboratory has been studying the merits of computer-controlled valves. The valve studies have been aimed at providing the Department of Defense with the capacity to conduct nuclear blast and thermal survivability testing on full-scale tactical vehicles. This report documents the development and findings of a computer model that simulates the behavior of the Eaton-Throat Valve Element (ETVE) prototype, and describes a proposed modification concept for the ETVE. The computer model reveals three main findings: (1) the ETVE chatters during the open cycle, (2) the chatter is caused by the high gas forces on the sliding sleeve as the driver gas passes through its portholes, and (3) the chatter is aggravated because there is insufficient damping in the system. The INEL recommends opening the ETVE by sliding the sleeve toward the downstream end of the valve instead of toward the upstream end, as the ETVE is presently configured, and to provide additional damping to the system. However, neither of these configuration changes can be achieved easily, and a redesign and analysis f the ETVE must be completed prior to performing any work on the current ETVE prototype. The ETVE simulation model proved to be an extremely valuable tool in analyzing the qualitative nature of the valve's operation. Further development of the model is recommended for quantitative analysis and design of the ETVE. This report explains the model and stress analysis findings, and proposes a redesign concept.

28388 (KCP–613-5384) **Integrated optical maze.** Roos, E.V.; Hendrix, J.L. Allied-Signal Aerospace Co., Kansas City, MO (United States). Kansas City Div. Jun 1994. 24p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00613. Order Number DE94015866. Source: OSTI; NTIS; GPO Dep.

Improvements to Nuclear Weapons Surety through the development of new detonation control techniques incorporating electro-optic technology are reviewed and proposed in this report. The results of the Kansas City Division's (KCD's) literature and vendor search, potential system architecture synthesis, and device test results are the basis of this report. This study has revealed several potential reconfigureable optical interconnect architectures that meet Los Alamos National Laboratory's preliminary performance specifications. Several planer and global architectures have the potential for meeting the Department of Energy's applications. Preliminary conclusions on the proposed architectures are discussed. The planer approach of monolithic GaAs amplifier switch arrays is the leading candidate because it meets most of the specifications now. $LiNbO_3$ and $LiTaO_3$ planer tree switch arrays are the second choice because they meet all the specifications except for laser power transmission. Although not atop choice, acousto-optical free space switch arrays have been considered and meet most of the specifications. Symmetric-Self Electro-Optic Effect Devices (S-SEED) free space switch arrays are being considered and have excellent potential for smart reconfigureable optical interconnects in the future.

28389 (KCP–613-5431) **Electron beam weld development on a Filter Pack Assembly: Final report.** Dereskiewicz, J.P. Allied-Signal Aerospace Co., Kansas City, MO (United States). Kansas City Div. Jun 1994. 48p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00613. Order Number DE94015867. Source: OSTI; NTIS; GPO Dep.

A continuous electron beam welding procedure was developed to replace the manual gas tungsten arc welding procedure on the Filter Pack Assembly. A statistical study was used to evaluate the feasibility of electron beam welding 6061-T6 aluminum covers to A356 cast weldments throughout the joint tolerance range specified on product drawings. Peak temperature exposures were not high enough to degrade the heat sensitive electrical components inside the cast weldment. Actual weldments with alodine coating on the weld joint area were successfully cleaned using a nonmetallic fiberglass brush cleaning method.

28390 (SAND–94-0784) **Overview of the instrument control and data reduction software in the Sandia data acquisition system at the Nevada Test Site.** Boyer, W.B. Sandia National Labs., Albuquerque, NM (United States). Jun 1994. 30p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. Order Number DE94015531. Source: OSTI; NTIS; GPO Dep.

Sandia National Laboratories has developed a sophisticated custom digital data acquisition system to record data from a wide variety of experiments conducted on nuclear weapons effects tests at the Nevada Test Site (NTS). Software is a critical part of this data acquisition system. In particular software has been developed to support an instrumentation/experiment setup database, interactive and automated instrument control, remote data readout and processing, plotting, interactive data analysis, and automated calibration. Some software is also used as firmware in custom subsystems incorporating embedded microprocessors. The software operations are distributed across the nearly 40 computer nodes that comprise the NTS Wide Area Computer Network. This report is an overview of the software developed to support this data acquisition system. The report also provides a brief description of the computer network and the various recording systems used.

28391 (SAND–94-2028C) **Portable, solid state, fiber optic coupled Doppler interferometer system for detonation and shock diagnostics.** Fleming, K.J. Sandia National Labs., Albuquerque, NM (United States). [1994]. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. (CONF-940776–7: 20. international pyrotechnics seminar, Colorado Springs, CO (United States), 25-29 Jul 1994). Order Number DE94016554. Source: OSTI; NTIS; GPO Dep.

VISAR (Velocity Interferometer System for Any Reflector) is a specialized Doppler interferometer system that is gaining worldwide acceptance as the standard for shock phenomena analysis. The VISAR's large power and cooling requirements, and the sensitive and complex nature of the interferometer cavity has restricted the traditional system to the laboratory. This paper describes the new portable VISAR, its peripheral sensors, and the role it played in optically measuring ground shock of an underground nuclear detonation (UGT). The Solid State VISAR uses a prototype diode pumped Nd:YAG laser and solid state detectors that provide a suitcase-size system with low power requirements. A special window and sensors was developed for fiber optic coupling (1 kilometer long) to the VISCAR. The system has proven itself as reliable, easy to use instrument that is capable of field test use and rapid data reduction using only a notebook personal computer (PC).

4503 Nuclear Explosion Detection

Refer also to citation(s) 28297, 28389

28392 (EGG–1183-281) **Study of focusing aid techniques.** Champeny, J.C.; Zavattaro, P.H. EG and G Energy Measurements, Inc., Las Vegas, NV (United States). 4 Mar 1966. 31p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC08-76NV01183. (EGG-B–3258). Order Number DE94015929. Source: OSTI; NTIS; GPO Dep.

The study of focusing aid techniques was conducted to evaluate the performance and convenience of the split image, projection, and ground glass techniques used for focusing oscilloscope cameras. Specifically, the study was intended (1) to determine the usefulness of projection-type focusing aid devices now used on EG&G Type 3171 cameras, (2) to lead to recommendations for the most satisfactory device for use with the new LC-4 type camera, and (3) to evaluate the usefulness of such devices for production-line focusing of EG&G Type 850 cameras. The study included a

brief theoretical evaluation of each focusing method and a statistical determination of actual performance. The primary tests were made using a simulated oscilloscope trace to insure reproducibility. Comparisons of the results were made on a Tektronix oscilloscope to confirm validity of the trace simulation. Most of the tests were made with an LC-4 camera because the Nikon lens used in the LC-4 camera will be used in future 3171 cameras. A few experiments were conducted to confirm the correctness of applying the LC-4 camera results to unmodified 3171 cameras. A special split image focusing aid developed at Lawrence Radiation Laboratory (LRL) for the LC-4 camera was used in the split image technique, and a type of focusing aid now commonly used with 3171 cameras was used in the projection technique. The ground glass technique was based on a method commonly used in optical work for critical focusing. Data were accumulated for each focusing technique, for different operators, and under different conditions so that reasonable statistical validity could be obtained.

28393 (EGG–1183-1219) **EG&G NERVA Test Operations progress report, February 1966.** EG and G, Inc., Las Vegas, NV (United States). 15 Mar 1966. 18p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC08-76NV01183. Order Number DE94015928. Source: OSTI; NTIS; GPO Dep.

This report describes EG&G activities in support of the NTO Test Cell A Program for February 1966. Details with respect to the various tasks included in our scope of work are discussed in succeeding sections and appendices. At Test Cell A, the NRX/EST test series continued with the performance of Experimental Plans IIA, IIB, and IIC. EG&G personnel maintained the test cell instrumentation and controls systems in a run condition and added new channels for the next experimental plan. This will be the last publication of the monthly EG&G/NTO progress report. The contractual agreements of the EG&G Electronics Support Services contract require a monthly technical and fiscal report. Reporting shall be in the following categories: (1) TCC; (2) TCA; (3) ETS-1; (4) R&E MAD Buildings; (5) Common Operational Support: (6) Miscellaneous; and (7) Central Support Shops. In addition EG&G will submit a weekly highlight report to SNPO-N with distribution to the users.

28394 (LA-SUB–93-312) **Interpretation of seismic reflection data from the Piledriver Event Area, Nevada Test Site; A case study for evaluation of technique for characterization of void and chimney features.** Tonander, K.E. (New Mexico Inst. of Mining and Technology, Socorro, NM (United States)). Los Alamos National Lab., NM (United States); New Mexico Inst. of Mining and Technology, Socorro, NM (United States). Spr 1993. 77p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. Order Number DE94015421. Source: OSTI; NTIS; GPO Dep.

A remote sensing geophysical method is needed to properly characterize the void and chimney characteristics of underground nuclear tests. Various techniques were considered and a seismic reflection survey was selected. This survey was then fitted to the conditions at the test site so as to give optimum results. The data was then reduced via DOS computer and analyzed for content. The planned survey using a 50 ft offset did not show any useful information, however, a second survey with a variable longer offset was also conducted which was capable of determining the depth to the top and the bottom of the chimney with reasonable accuracy. Measurements of the horizontal spread of the structure, though, were inconclusive.

28395 (LA-SUB–94-43) **Seismic decoupling of an explosion centered in a granite chimney rubble – scaled experiment results: Final report.** Keller, C. (Science & Engineering Associates, Inc., Santa Fe, NM (United States)); Miller, S.; Florence, A.; Fogle, M.; Kilb, D. Los Alamos National Lab., NM (United States); Science and Engineering Associates, Inc., Santa Fe, NM (United States). Dec 1991. 218p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (SEASF-TR–91-008). Order Number DE94017050. Source: OSTI; NTIS; GPO Dep.

This report describes the small scale evaluation of the feasibility of significant decoupling by siting an explosion in granite rubble. The chimney characteristics scaled to laboratory dimensions were those of the PILE DRIVER event. The scaled charges were of 1 KT and 8KT in the PILE DRIVER chimney. The measure of the effect was the velocity field history in the granite outside the chimney volume with the chimney rubble and with no rubble. A number of chimney sizes and shapes were studied. The explosion process was modeled via two-din=mensional, finite-difference methods used for prediction of velocity histories at the Nevada Test Site. The result was that both the spectral shape and the magnitude of the transmitted shock wave were drastically altered. The chimney geometry was as important as the rubble characteristics.

28396 (PNL-SA–23966) **Dynamic Bayesian filtering for real-time seismic analyses.** Blough, D.K.; Rohay, A.C.; Anderson, K.K.; Nicholson, W.L. Pacific Northwest Lab., Richland, WA (United States). Apr 1994. 22p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. (CONF-9404100–10: Symposium on the non-proliferation experiment results and implications for test ban treaties, Rockville, MD (United States), 19-21 Apr 1994). Order Number DE94015206. Source: OSTI; NTIS; GPO Dep.

State space modeling, which includes techniques such as the Kalman filter, has been used to analyze many non-stationary time series. The ability of these dynamic models to adapt and track changes in the underlying process makes them attractive for application to the real-time analysis of three-component seismic waveforms. The authors are investigating the application of state space models formulated as Bayesian time series models to phase detection, polarization, and spectrogram estimation of seismograms. This approach removes the need to specify data windows in the time series for time averaging estimation (e.g., spectrum estimation). They are using this model to isolate particular seismic phases based on polarization parameters that are determined at a spectrum of frequencies. They plan to use polarization parameters, frequency spectra, and magnitudes to discriminate between different types of seismic sources. They present the application of this technique to artificial time series and to several real seismic events including the Non-Proliferation Experiment (NPE) two nuclear tests and three earthquakes from the Nevada Test site, as recorded on several regional broadband seismic stations. A preliminary result of this analysis indicates that earthquakes and explosions can potentially be discriminated on the bass of the polarization characteristics of scattered seismic phases. However, the chemical (NPE) and nuclear explosions appear to have very similar polarization characteristics.

28397 (UCRL-JC–116428) **The influence of material models on chemical or nuclear-explosion source functions.** Glenn, L.A.; Goldstein, P. Lawrence Livermore National Lab., CA (United States). Apr 1994. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-9404100–8: Symposium on the non-proliferation experiment results and implications for test ban treaties, Rockville, MD (United States), 19-21 Apr 1994). Order Number DE94014739. Source: OSTI; NTIS; GPO Dep.

Physical models of explosion sources are needed to explain the variations in the performance of existing discriminants in different regions, and to help develop more robust methods for identifying underground explosions. In this paper, we assess the sensitivity of explosion source functions to material properties by means of numerical simulations. Specifically, we have calculated the effect of varying the yield strength, overburden pressure, and gas porosity on the spectra of the reduced velocity potential for both nuclear and chemical explosions, and compared these with experimental results derived from free-field particle acceleration and regional seismic (LNN) data. The chemical-explosion calculations were intended to simulate the kiloton experiment recently conducted in Area 12 of the Nevada Test Site (NTS) that has been dubbed the Non-Proliferation Experiment (NPE). We found that the asymptotic (long period) value of the reduced displacement potential, ϕ_{∞}, for explosions with the ANFO blasting agent used in the NPE, was larger than that derived for a tamped nuclear explosion of the same yield by a factor of 1.9, in good agreement with the experimental results derived from free-field particle velocity measurements, and also with $m_b(P_n)$ data from the Livermore Nevada Network (LNN).

4505 Strategic Defense Initiative

28398 (UCRL-ID–118200) **MEDUSA: A concept for countering multiple targets from theater ballistic missiles: Final report.** Peglow, S.G. Lawrence Livermore National Lab., CA (United States). Apr 1994. 17p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. Order Number DE94016634. Source: OSTI; NTIS; GPO Dep.

We feel that the concept of intercepting a fractionated threat from a tactical ballistic missile is potentially feasible and would have very high payoff for the defense. Many other concepts have been suggested to solve this problem, although they have mostly been more futuristic approaches, e.g. aircrafty based lasers. We also believe that current technologies are not likely to be adequate for the expected types of very small submunition payloads, especially in the presence of relatively simple countermeasures. The MEDUSA concept, or its clones, may very well provide a vehicle for the study of less stressing threats, e.g. separating warheads and provide a lethality enhancement for non-deployed payloads. An opportunity also exists to investigate alternative technologies, such as the explosively-formed "disk" idea. The use of high-precision, limited field-of-view sensor-fuzed munitions is a subject of interest in other Defense Department programs and may have application to the important area of theater missile defense.

4506 Chemical and Biological

Refer also to citation(s) 28478

28399 (PNL–9818) **Acute environmental toxicity and persistence of methyl salicylate: A chemical agent simulant: Final report.** Cataldo, D.A.; Ligotke, M.W.; Harvey, S.D.; Fellows, R.J.; Li, S.W. Pacific Northwest Lab., Richland, WA (United States). Jun 1994. 66p. Sponsored by Department of Defense, Washington, DC (United States). DOE Contract AC06-76RL01830. (TD–2089). Order Number DE94015192. Source: OSTI; NTIS; INIS; GPO Dep.

The interactions of methyl salicylate with plant foliage and soils were assessed using aerosol/vapor exposure methods. Measurements of deposition velocity and residence times for soils and foliar surfaces are reported. Severe plant contact toxicity was observed at foliar mass-loading levels above 4 $\mu g/cm^2$ leaf; however, recovery was noted after four to fourteen days. Methyl salicylate has a short-term effect on soil dehydrogenase activity, but not phosphatase activity. Results of the earthworm bioassay indicated only minimal effects on survival.

28400 (UCRL-ID–116939) **A small, portable gas chromatograph-quadrupole mass spectrometer for on-site analysis.** Andresen, B.; Coutts, G.; Alcaraz, A.; Bushman, J.; Cornish, J. Lawrence Livermore National Lab., CA (United States). Apr 1994. 20p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. Order Number DE94016628. Source: OSTI; NTIS; GPO Dep.

Gas chromatography-mass spectrometry (GC-MS) is the analytical tool of choice for the exact identification of unknown organic chemicals in environmental samples. Capillary gas chromatography, combined with the specific identification capabilities of mass spectrometry, allows the rapid and complete characterization of individual compounds in complex mixtures. As the technology has developed, many manufacturers have offered bench-top MS systems that provide a variety of analytical capabilities. Many instruments have been promoted as "detectors for gas chromatography." More recently, manufacturers have offered integrated packages that can be transported to the field to provide analytical capabilities previously available only in the laboratory. The demonstrated field utility of these field-transportable units has triggered an interest in smaller, lighter weight, and more portable instruments. However, the current weight (>100 lb), large size, and laboratory-based power consumption requirements of these units is viewed as a liability by some potential field instrument users. Over the past several years, the interest in field-deployable instruments has resulted in research and development into smaller GC-MS systems designed with limited applications. While the development of these instruments is certainly worthwhile, a reliable and robust GC-MS instrument that clearly addresses the field-deployable needs for all environmental sampling and analysis would have considerable utility. We have developed portable instruments with analytical performance characteristics similar to those obtained with bench-top instruments. The current instrument, developed at LLNL and described here, was originally designed for use by on-site inspection teams supporting the Chemical Weapons Convention (CWC). The portability and expanded capabilities of this integrated instrument now make it a useful tool for environmental monitoring and on-site analysis studies.

54 ENVIRONMENTAL SCIENCES

Refer also to citation(s) 27384, 27445

5401 Environmental Sciences, Atmospheric

Refer also to citation(s) 27218, 27412, 27440, 27448, 27459, 27460, 27462, 27805, 27853, 27855, 27856, 27857, 27863, 27874, 27983, 28292, 28346, 28348, 28349, 28350, 28351, 28352, 28353, 28354, 28355, 28356, 28357, 28358, 28367, 28368, 28490, 28926, 28928

28401 (ANL/DIS/TM–14) **Recovery from a chemical weapons accident or incident: A concept paper on planning.** Herzenberg, C.L. (Argonne National Lab., IL (United States)); Haffenden, R.; Lerner, K.; Meleski, S.A.; Tanzman, E.A.; Lewis, L.M.; Hemphill, R.C.; Adams, J.D. Argonne National Lab., IL (United States). Apr 1994. 110p. Sponsored by Department of Defense, Washington, DC (United States). DOE Contract W-31109-ENG-38. Order Number DE94015009. Source: OSTI; NTIS; GPO Dep.

Emergency planning for an unintended release of chemical agent from the nation's chemical weapons stockpile should include preparation for. the period following implementation of immediate emergency response. That period – the recovery, reentry, and restoration stage – is the subject of this report. The report provides an overview of the role of recovery, reentry, and restoration planning in the Chemical Stockpile Emergency Preparedness Program (CSEPP), describes the transition from immediate emergency response to restoration, and analyzes the legal framework that would govern restoration activities. Social, economic, and administrative issues, as well as technical ones, need to be considered in the planning effort. Because of possible jurisdictional conflicts, appropriate federal, state, and local agencies need to be included in a coordinated planning process. Advance consideration should be given to the pertinent federal and state statutes and regulations. On the federal level, the principal statutes and regulations to be considered are those associated with the Comprehensive Environmental Response, Compensation, and Liability Act; the Resource Conservation and Recovery Act; and the National Environmental Policy Act. This report recommends that extensive preaccident planning be undertaken for the recovery, reentry, and restoration stage and outlines several key issues that should be considered in that planning. The need for interagency cooperation and coordination at all levels of the planning process is emphasized.

28402 (ANL/ER/CP–83276) **Remote sensing strategy at the first Atmospheric Radiation Measurement field site.** Wesely, M.L. (Argonne National Lab., IL (United States)); Griffin, J.W. Argonne National Lab., IL (United States); Pacific Northwest Lab., Richland, WA (United States). [1994]. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38 ; AC06-76RL01830. (CONF-9408118–1: 3. international symposium on tropospheric profiling: needs and technologies, Hamburg (Germany), 30 Aug - 2 sep 1994). Order Number DE94015091. Source: OSTI; NTIS; GPO Dep.

The Atmospheric Radiation Measurement (ARM) Program was initiated in 1990 by the US Department of Energy to improve climate model simulations of radiative energy transport and cloud formation, maintenance, and dissipation. ARM stresses the modeling of phenomena occurring at subgrid scales in general circulation models (GCMs). Measurements to support the modeling research will be made at three primary locations. The central facility, the primary location at the Southern Great Plains (SGP) site for study of

radiative transfer, uses ground-based remote sensing instrumentation to observe radiation and the atmospheric properties that affect it. Remote sensing instruments and balloon-borne sounding systems installed at several boundary facilities on the perimeter of the overall Cloud and Radiation Testbed (CART) site evaluate vertical profiles of wind, temperature, and humidity. These observations are needed to run single-column models derived from GCMs for a single grid square with an area equivalent to the overall CART area. Observations of local meteorological conditions, air-surface exchange, and solar and infrared radiation at up to 23 extended facilities scattered throughout the CART site provide the surface boundary information needed in the single-column models. Finally, auxiliary facilities at the central facility and at a few locations within 10 km of the central facility will contain whole-sky imaging systems to map cloud characteristics. The purpose of this presentation is to describe the strategy used to obtain remote sensing instrumentation for continuous operation at the central facility.

28403 (CONF-9303122–, pp. 1-10) **A study of longwave radiation codes for climate studies: Validation with observations and tests in general circulation models - and update.** Ellingson, R.G. (Univ. of Maryland, College Park, MD (United States)); Baer, F. USDOE Office of Energy Research, Washington, DC (United States). Mar 1994. From 3. Atmospheric Radiation Measurement (ARM) science team meeting; Norman, OK (United States); 1-5 Mar 1993. In *Proceedings of the third Atmospheric Radiation Measurement (ARM) science team meeting.* 379p. Source: OSTI; NTIS; INIS.

One specific goal of the Atmospheric Radiation Measurement (ARM) Program is to improve the treatment of radiative transfer in GCMs under clear-sky, general overcast, and broken cloud conditions. Research goals developed to overcome the problems of longwave radiation are: Develop for use in GCMs an optimum longwave radiation model that has been calibrated with state of the art observations; Assess the impact of the longwave radiative forcing in a GCM; Determine the sensitivity of a GCM to the radiative model used in it; Determine how the longwave radiative forcing contributes relatively when compared with shortwave radiative forcing, sensible heating, thermal advection and expansion. The approach to developing the radiation model is to test existing models in an iterative, predictive fashion. This report summarizes results obtained since the last ARM Science Team meeting under the categories of Radiation Model Testing Activities and General Circulation Model Testing Activities.

28404 (CONF-9303122–, pp. 11-17) **Radiative transfer model development in support of the Atmospheric Radiation Measurement Program.** Clough, S.A. (Atmospheric and Environmental Research Inc., Cambridge, MA (United States)). USDOE Office of Energy Research, Washington, DC (United States). Mar 1994. From 3. Atmospheric Radiation Measurement (ARM) science team meeting; Norman, OK (United States); 1-5 Mar 1993. In *Proceedings of the third Atmospheric Radiation Measurement (ARM) science team meeting.* 379p. Source: OSTI; NTIS; INIS.

The objective of this research effort is to develop radiative transfer models that are consistent with Atmospheric Radiation Measurement (ARM) Program spectral radiance measurements for clear and cloudy atmospheres. Our approach is to develop the model physics and related databases with a line-by-line model in the context of available spectral radiance measurements. The line-by-line model then functions as an intermediate standard to both develop and validate rapid radiative transfer models appropriate to GCM applications.

28405 (CONF-9303122–, pp. 19-22) **General circulation model feedback sensitivity assessment.** Lacis, A.A. (NASA Goddard Space Flight Center, New York, NY (United States)). USDOE Office of Energy Research, Washington, DC (United States). Mar 1994. From 3. Atmospheric Radiation Measurement (ARM) science team meeting; Norman, OK (United States); 1-5 Mar 1993. In *Proceedings of the third Atmospheric Radiation Measurement (ARM) science team meeting.* 379p. Source: OSTI; NTIS; INIS.

Estimating the magnitude of the climate system response to a radiative forcing perturbation is made difficult by feedback contributions that can magnify or diminish the initial effect of the forcing. The relative strengths of the different climate feedbacks can be determined by computing the magnitude of the change in equilibrium surface temperature attributable to specific changes in atmospheric structure and/or to changes in the concentration and distribution of the radiatively active constituents. This information can be obtained by using a 2-Dimensional Radiative-Convective-Advective equilibrium model (2-D RCAM) to analyze the changes in the latitudinal energy balance that take place between the GCM experiment and the GCM control run. The input information required for this analysis consists of the zonally averaged annual average temperature and water vapor profiles, advected energy transports, cloud cover, and surface albedo from the GCM experiment and control runs.

28406 (CONF-9303122–, pp. 31-34) **Radiative properties of nonuniform clouds.** Daum, P.H. (Brookhaven National Laboratory, Upton, NY (United States)); Kleinman, L.I.; Stephens, G.L. USDOE Office of Energy Research, Washington, DC (United States). Mar 1994. From 3. Atmospheric Radiation Measurement (ARM) science team meeting; Norman, OK (United States); 1-5 Mar 1993. In *Proceedings of the third Atmospheric Radiation Measurement (ARM) science team meeting.* 379p. Source: OSTI; NTIS; INIS.

Reported here are results from two experiments for the Atmospheric Radiation Monitoring (ARM) Program. The first experiment is mechanistic in character and focuses on testing general circulation models (GCMs) parameterization of cloud radiative properties. In this experiment, Cloud and Radiation Testbed (CART) measurements of solar flux and integrated liquid water content are used to obtain an empirical relationship between the diffuse transmission of stratus clouds and the liquid water path (LWP). The second experiment is a prototype of a set of experiments exploring broad climatological relations between radiative properties of the atmosphere and other key atmospheric parameters, both as a general test of parameterizations and as a way of introducing new diagnostic analysis procedures which can be used to test global climate models. First efforts evaluate a simple graybody relationship between the downwelling longwave flux at the surface, the outgoing longwave flux at the top of the atmosphere, and the column integrated water vapor content.

28407 (CONF-9303122–, pp. 35-38) **A stochastic formulation of radiative transfer in clouds.** Stephens, G.L. (Colorado State Univ., Ft. Collins, CO (United States)); Gabriel, P.M.; Evans, K.F.; Duda, D. USDOE Office of Energy Research, Washington, DC (United States). Mar 1994. From 3. Atmospheric Radiation Measurement (ARM) science team meeting; Norman, OK (United States); 1-5 Mar 1993. In *Proceedings of the third Atmospheric Radiation Measurement (ARM) science team meeting.* 379p. Source: OSTI; NTIS; INIS.

The research conducted as part of this project breaks down into three broad areas: deterministic radiative transfer, remote sensing; stochastic radiative transfer. The approach pursued in this research employs different forms of radiative transfer models in one, two, and three dimensions in an attempt to understand radiative transfer in clouds with realistic spatial structure and to determine the key geometrical parameters that influence this transfer. A key focus is understanding the relative importance of these geometrical effects in contrast to the microphysical effects of clouds. The main conclusion is that geometry has a profound influence on all aspects of radiative transfer and the interpretation of this transfer.

28408 (CONF-9303122–, pp. 39-43) **Two complementary multifractal analysis techniques for non-stationary atmospheric processes with an application to cloud liquid water content.** Wiscombe, W. (NASA Goddard Space Flight Center, Greenbelt, MD (United States)); Davis, A.; Marshak, A. USDOE Office of Energy Research, Washington, DC (United States). Mar 1994. From 3. Atmospheric Radiation Measurement (ARM) science team meeting; Norman, OK (United States); 1-5 Mar 1993. In *Proceedings of the third Atmospheric Radiation Measurement (ARM) science team meeting.* 379p. Source: OSTI; NTIS; INIS.

The authors characterize the 3D structure of clouds (as sampled by 1D transects of liquid water content (LWC)) using extensions of simple, robust, and turbulence–proven multifractal statistical methods and models. The goal is to develop the simplest possible stochastic models with the minimum number of free parameters, yet one capable of capturing variability on the widest possible

range of scales. Not only is this an important prelude to the theoretical and empirical study of cloud radiation problems, but also has applications to other ARM Programs such as comparison of model output with ARM observations at a much deeper level than traditional mean-variance, and interpolations and extrapolations in space and time scale.

28409 (CONF-9303122–, pp. 45-50) **Treatment of cloud radiative effects in general circulation models.** Wang, W.C. (State Univ. of New York, Albany, NY (United States)); Liang, X.Z.; Dudek, M.P.; Ding, M.; Zhu, L.; Everette, J.; Cox, S. USDOE Office of Energy Research, Washington, DC (United States). Mar 1994. From 3. Atmospheric Radiation Measurement (ARM) science team meeting; Norman, OK (United States); 1-5 Mar 1993. In *Proceedings of the third Atmospheric Radiation Measurement (ARM) science team meeting.* 379p. Source: OSTI; NTIS; INIS.

The authors participate in the Atmospheric Radiation Measurement (ARM) Program with two objectives: (1) to improve the general circulation model (GCM) cloud/radiation treatment with a focus on cloud overlapping and the cloud optical properties and (2) to study the effects of cloud/radiation-climate interaction on climate simulations. This paper summarizes the project progress since the second ARM Science Team meeting October 26-30, 1992, in Denver, Colorado. Four graduate students participated in the research.

28410 (CONF-9303122–, pp. 51-54) **Cloud effects on radiation at the top of the atmosphere and at the surface: Observations and modeling studies.** Gautier, C. (Univ. of California, Santa Barbara, CA (United States)); Lavallee, D.; O'Hirok, W.; Figel, T.; Landfield, M.; Ricchiazzi, P.; Yang, S.; Lubin, D.; Lovejoy, S.; Larnder, C. USDOE Office of Energy Research, Washington, DC (United States). Mar 1994. From 3. Atmospheric Radiation Measurement (ARM) science team meeting; Norman, OK (United States); 1-5 Mar 1993. In *Proceedings of the third Atmospheric Radiation Measurement (ARM) science team meeting.* 379p. Source: OSTI; NTIS; INIS.

The main goal of this project is to study the effects of clouds, particularly those with inhomogenous spatial properties, on radiation at the top of the atmosphere and at the surface. A combination of observations from space and at the surface and models were used to diagnose processes and predict relationships between cloud properties and radiation fields. In addition,theoretical foundations are developed for the main analysis procedure, which is based on multifractal theory and analysis techniques. Preliminary analysis of data involves computing the surface shortwave irradiance data from the Visible and Infrared Spin-Scan Radiometer (VISSR) on the Geostationary Operational Environmental Satellite (GOES), as well as estimating the multifractal properties of the cloud radiance field observed by the satellite. The modeling activities encompass diagnostic studies with a number of radiative transfer codes. In addition, a number of multifractal analyses have been performed with satellite data, and new radiative transfer simulations have been achieved.

28411 (CONF-9303122–, pp. 55-57) **Analysis of cloud radiative forcing and feedback in a climate general circulation model.** Lacis, A.A. (NASA Goddard Space Flight Center, New York, NY (United States)). USDOE Office of Energy Research, Washington, DC (United States). Mar 1994. From 3. Atmospheric Radiation Measurement (ARM) science team meeting; Norman, OK (United States); 1-5 Mar 1993. In *Proceedings of the third Atmospheric Radiation Measurement (ARM) science team meeting.* 379p. Source: OSTI; NTIS; INIS.

The principal objectives of the Atmospheric Radiation Measurement (ARM) Program research at the Goddard Institute for Space Studies (GISS) are (1) to improve and validate the radiation parameterization in the GISS general circulation model (GCM) through model intercomparisons with line-by-line calculations and through comparisons with ARM observations, (2) to improve the GCM diagnostic output to enable more effective comparisons to global cloud/radiation data sets, and (3) to use ARM Cloud and Radiation Testbed (CART) data to develop improved parameterization of clouds in the GCM and to study the interaction of dynamics and radiation.

28412 (CONF-9303122–, pp. 59-65) **Stochastic radiation transport for climate models.** Byrne, R.N. (Science Applications International Corp., San Diego, CA (United States)); Arion, D.N.; Malvagi, F.; Serra, Y.; Somerville, R.C.J.; Pomraning, G.C.; Su, B.J. USDOE Office of Energy Research, Washington, DC (United States). Mar 1994. From 3. Atmospheric Radiation Measurement (ARM) science team meeting; Norman, OK (United States); 1-5 Mar 1993. In *Proceedings of the third Atmospheric Radiation Measurement (ARM) science team meeting.* 379p. Source: OSTI; NTIS; INIS.

Mathematical models are being developed to predict cloud morphology based upon knowledge of the local intrinsic variables such as heating rate and humidity profiles. Among the desired variables are the size distribution, in space and optical depth, of the clouds. The approach is to use ARM data to determine the statistics of observed cloud fields and to calculate the resulting radiation transport in a statistical manner such that average energy balance can be predicted from knowledge of the average statistics. The are four general areas of research in this endeavor: Functional cloud cover; Theory of stochastic transfer; Effect on model calculations; and Tests of stochastic theory.

28413 (CONF-9303122–, pp. 67-72) **A model of the microphysical evolution of a cloud.** Zinn, J. (Los Alamos National Laboratory, NM (United States)). USDOE Office of Energy Research, Washington, DC (United States). Mar 1994. From 3. Atmospheric Radiation Measurement (ARM) science team meeting; Norman, OK (United States); 1-5 Mar 1993. In *Proceedings of the third Atmospheric Radiation Measurement (ARM) science team meeting.* 379p. Source: OSTI; NTIS; INIS.

The earth's weather and climate are influenced strongly by phenomena associated with clouds. Therefore, a general circulation model (GCM) that models the evolution of weather and climate must include an accurate physical model of the clouds. This paper describes efforts to develop a suitable cloud model. It concentrates on the microphysical processes that determine the evolution of droplet and ice crystal size distributions, precipitation rates, total and condensed water content, and radiative extinction coefficients.

28414 (CONF-9303122–, pp. 73-76) **The sensitivity of flux parameterizations to surface characteristics.** Doran, J.C. (Pacific Northwest Laboratory, Richland, WA (United States)). USDOE Office of Energy Research, Washington, DC (United States). Mar 1994. DOE Contract AC06-76RL01830. From 3. Atmospheric Radiation Measurement (ARM) science team meeting; Norman, OK (United States); 1-5 Mar 1993. In *Proceedings of the third Atmospheric Radiation Measurement (ARM) science team meeting.* 379p. Source: OSTI; NTIS; INIS.

The problem of measuring or calculating appropriate surface heat and moisture fluxes for use in general circulation models (GCMs) and single-column models (SCMs) is an important one. For this discussion, three issues are considered: 1. From measurements of surface fluxes at a finite number of points, how can one interpolate/extrapolate to get the average flux over an area covered by an SCM or a GCM grid cell? 2. How are fluxes parameterized in models? 3. How much does it matter if fluxes are not correctly parameterized or if incorrect flux values are used? To address these questions, results from both observations and model simulations are described. These results show differences in boundary layer properties over adjacent areas with differing surface characteristics. Such differences can have important consequences for the determination of area-averaged flux values from point measurements.

28415 (CONF-9303122–, pp. 77-81) **Areally averaged estimates of surface heat flux from field studies for the Atmospheric Radiation Measurement Program.** Coulter, R.L. (Argonne National Laboratory, IL (United States)); Martin, T.J.; Cook, D.R. USDOE Office of Energy Research, Washington, DC (United States). Mar 1994. From 3. Atmospheric Radiation Measurement (ARM) science team meeting; Norman, OK (United States); 1-5 Mar 1993. In *Proceedings of the third Atmospheric Radiation Measurement (ARM) science team meeting.* 379p. Source: OSTI; NTIS; INIS.

The determination of areally averaged surface fluxes is a problem of fundamental interest to the ARM Program. As the Cloud

and Radiation Testbed (CART) sites become fully operational, several different types of measurements, including vertical profiles of meteorological variables, can potentially be used synergistically with point measurements to provide reliable estimates of surface fluxes averaged over large areas. To investigate these problems, ARM science team members conducted a field study on a site chosen to provide strong contrasts in surface moisture while minimizing the differences in topography.

28416 (CONF-9303122–, pp. 83-87) **Surface fluxes important to cloud development.** Barnes, F.J. (Los Alamos National Laboratory, NM (United States)); Porch, W.; Kunkel, K.E. USDOE Office of Energy Research, Washington, DC (United States). Mar 1994. From 3. Atmospheric Radiation Measurement (ARM) science team meeting; Norman, OK (United States); 1-5 Mar 1993. In *Proceedings of the third Atmospheric Radiation Measurement (ARM) science team meeting.* 379p. Source: OSTI; NTIS; INIS.

To address some of the issues in scaling and averaging of measurements, an ARM Program team conducted collaborative field campaigns in Boardman, Oregon. Two distinct regions were selected where the sensible and latent heat fluxes would differ sharply, and where each region was sufficiently extensive enough to allow full development of boundary layers and use of aircraft-mounted instrument systems. Measurements were clustered along a 16-km transect across adjoining irrigated farmland and semi-arid rangeland that allowed the collaborating teams to conduct studies focused on assessing the effects of different surface characteristics on fluxes of heat and water vapor. Tasks included: Intercomparison of micrometeorological instrument performance; Determination of fine-scale variability of surface fluxes over dry grassland and farmland and its relationship to variability in surface soil moisture, crop type and leaf area or biomass; Comparison of spatially averaged optical measurements of heat fluxes and convergence with micrometeorological measurements, high-frequency Doppler acoustic measurements, and multi-spectral cloud images and cloud height measurements; Determination of evapotranspiration (ET) from water balance estimates of 4 crops in the agricultural area and comparison to micrometeorological measurements of ET.

28417 (CONF-9303122–, pp. 89-95) **An ultra-high frequency boundary layer Doppler/interferometric profiler.** Van Baelen, J.S. (National Center for Atmospheric Research, Boulder, CO (United States)). USDOE Office of Energy Research, Washington, DC (United States). Mar 1994. From 3. Atmospheric Radiation Measurement (ARM) science team meeting; Norman, OK (United States); 1-5 Mar 1993. In *Proceedings of the third Atmospheric Radiation Measurement (ARM) science team meeting.* 379p. Source: OSTI; NTIS; INIS.

The planetary boundary layer (PBL) is that portion of the earth's atmosphere that is directly influenced by the earth's surface. The PBL can be vigorously turbulent and range in depth from a few hundred meters to a few kilometers. Solar energy is primarily absorbed at the earth's surface and transmitted to the free atmosphere through boundary-layer processes. An accurate portrayal of these transfers within the PBL is crucial to understand and predict many atmospheric processes from pollutant dispersion to numerical weather prediction and numerical simulations of climate change. This paper describes and discusses wind profiling techniques, focusing on the newly developed radio acoustic sounding system (RASS), and reviews past efforts to measure flux within the PBL. A new UHF wind profiling radar, the UHF Doppler/Interferometric Boundary Layer Radar, for accurately measuring both mean and flux quantities, as well as wind divergence and acoustic wave propagation, is outlined.

28418 (CONF-9303122–, pp. 101-104) **Single-column model and cumulus ensemble model simulations of GARP Atlantic Tropical Experimental Data.** Randall, D.A. (Colorado State Univ., Fort Collins, CO (United States)); Xu, K.M. USDOE Office of Energy Research, Washington, DC (United States). Mar 1994. From 3. Atmospheric Radiation Measurement (ARM) science team meeting; Norman, OK (United States); 1-5 Mar 1993. In *Proceedings of the third Atmospheric Radiation Measurement (ARM) science team meeting.* 379p. Source: OSTI; NTIS; INIS.

This ARM project consists of developing and demonstrating improved cloud formation parameterizations by using both a single-column model (SCM) and a cumulus ensemble model (CEM), together with ARM data. These two models can be driven with large-scale forcing. The SCM does so through its physical parameterizations, while the CEM does so by directly simulating convective cloud circulations. To further test these improved parameterizations, progress in the following areas is discussed: Develop improved cloudiness parameterizations; Develop improvements to the CEM, with emphasis on cloud-radiation interactions; Drive both models with ARM data; Transfer the improved parameterizations developed in this way to the CSU general circulation model (GCM).

28419 (CONF-9303122–, pp. 105-107) **Diagnostic modeling of the experimental site of the Atmospheric Radiation Measurement Program.** Somerville, R.C.J. (Univ. of California, San Diego, CA (United States)); Iacobellis. USDOE Office of Energy Research, Washington, DC (United States). Mar 1994. From 3. Atmospheric Radiation Measurement (ARM) science team meeting; Norman, OK (United States); 1-5 Mar 1993. In *Proceedings of the third Atmospheric Radiation Measurement (ARM) science team meeting.* 379p. Source: OSTI; NTIS; INIS.

Our project is centered around a computationally efficient and economical one-dimensional (vertical) model, resembling a single column of a general circulation model (GCM) grid, applied to the experimental site of the Atmospheric Radiation Measurement (ARM) Program. The model contains a full set of modern GCM parameterizations of subgrid physical processes. To force the model, the advective terms in the budget equations are specified observationally from operational numerical weather prediction analyses. These analyses, based on four-dimensional data assimilation techniques, provide dynamically consistent wind fields and horizontal gradients of temperature and moisture.

28420 (CONF-9303122–, pp. 109-112) **A strategy for testing the impact of clouds on the shortwave radiation budge of general circulation models: A prototype for the Atmospheric Radiation Measurement Program.** Cess, R.D. (State Univ. of New York, Stony Brook, NY (United States)). USDOE Office of Energy Research, Washington, DC (United States). Mar 1994. From 3. Atmospheric Radiation Measurement (ARM) science team meeting; Norman, OK (United States); 1-5 Mar 1993. In *Proceedings of the third Atmospheric Radiation Measurement (ARM) science team meeting.* 379p. Source: OSTI; NTIS; INIS.

Cloud-climate interactions are one of the greatest uncertainties in contemporary general circulation models (GCMs), and this study has focused on one aspect of this. Specifically, combined satellite and near-surface shortwave (SW) flux measurements have been used to test the impact of clouds on the SW radiation budgets of two GCMs. Concentration is initially on SW rather than longwave (LW) radiation because, in one of the GCMs used in this study an SW radiation inconsistency causes a LW inconsistency. The surface data consist of near-surface insolation measured by the upward facing pyranometer at the Boulder Atmospheric Observatory tower. The satellite data consist of top of the atmosphere (TOA) albedo data, collocated with the tower location, as determined from the GOES SW spin-scan radiometer. Measurements are made every half hour, with hourly means taken by averaging successive measurements. The combined data are for a 21-day period encompassing 28 June through 18 July 1987 and consist of 202 combined albedo/insolation measurements.

28421 (CONF-9303122–, pp. 113-117) **A stratiform cloud parameterization for general circulation models.** Ghan, S.J. (Pacific Northwest Laboratory, Richland, WA (United States)); Leung, L.R.; Chuang, C.C.; Penner, J.E.; McCaa, J. USDOE Office of Energy Research, Washington, DC (United States). Mar 1994. From 3. Atmospheric Radiation Measurement (ARM) science team meeting; Norman, OK (United States); 1-5 Mar 1993. In *Proceedings of the third Atmospheric Radiation Measurement (ARM) science team meeting.* 379p. Source: OSTI; NTIS; INIS.

The crude treatment of clouds in general circulation models (GCMs) is widely recognized as a major limitation in applying these models to predictions of global climate change. The purpose of this project is to develop in GCMs a stratiform cloud parameterization that expresses clouds in terms of bulk microphysical properties and

their subgrid variability. Various clouds variables and their interactions are summarized. Precipitating cloud species are distinguished from non-precipitating species, and the liquid phase is distinguished from the ice phase. The size of the non-precipitating cloud particles (which influences both the cloud radiative properties and the conversion of non-precipitating cloud species to precipitating species) is determined by predicting both the mass and number concentrations of each species.

28422 (CONF-9303122–, pp. 119-122) **Factors influencing regional-scale cloud cover: investigations using satellite-derived cloud cover and standard meterological observations.** Walcek, C.J. (State Univ. of New York, Albany, NY (United States)). USDOE Office of Energy Research, Washington, DC (United States). Mar 1994. From 3. Atmospheric Radiation Measurement (ARM) science team meeting; Norman, OK (United States); 1-5 Mar 1993. In *Proceedings of the third Atmospheric Radiation Measurement (ARM) science team meeting.* 379p. Source: OSTI; NTIS; INIS.

Large-scale numerical models of the atmosphere approximate the heterogeneous or subgrid-scale nature of cloudiness by assuming that a fraction of each grid area is occupied by clouds. This cloud cover fraction is used to apportion cloud effects into a "grid-averaged" forcing within areas that contain a mixture of clear and cloudy regions. Most models of tropospheric dynamics assume that the fractional cloud coverage is determined by the grid-averaged relative humidity, stability, or resolvable-scale vertical motions. In this study, the relationships between cloud cover and other related meterological factors are investigated by comparing observations of clouds and relative humidity, temperature lapse rates, wind shear, and large-scale vertical velocity within various tropospheric levels. Findings indicate significant correlations between cloud cover and relative humidity and vertical velocity. Comparison suggest that cloud coverage decreases exponentially as humidity fall below 100%. These results suggest that current methods of calculating cloud cover with large-scale climate simulations or atmospheric chemical modeling studies are significantly underestimating the effects of clouds.

28423 (CONF-9303122–, pp. 123-126) **Single-column subgrid cumulus model for the Atmospheric Radiation Measurement Program.** Stull, R.B. (Univ. of Wisconsin, Madison, WI (United States)). USDOE Office of Energy Research, Washington, DC (United States). Mar 1994. From 3. Atmospheric Radiation Measurement (ARM) science team meeting; Norman, OK (United States); 1-5 Mar 1993. In *Proceedings of the third Atmospheric Radiation Measurement (ARM) science team meeting.* 379p. Source: OSTI; NTIS; INIS.

Variations in surface albedo, moisture, soil type, vegetation coverage, and other factors cause surface-layer air to be horizontally heterogeneous over land surfaces. This heterogeneity causes patchiness in boundary layer cloud coverage because clouds are formed in thermals of rising surface-layer air. For climate models the effect of these variations can be captured via their statistical distributions within each grid cell, and parameters describing these distributions can be used to forecast subgrid scale boundary-layer clouds. The approach reported here uses subgrid statistics together with phenomenological characteristics of thermals to produce a diagnosis of cloud cover and other characteristics. Hence the name stochastic-phenomenological parameterization. When this parameterization is combined with a forecast model of the boundary layer, the result is a computationally efficient yet physically realistic parameterization for subgrid boundary-layer clouds within any single column of a climate model.

28424 (CONF-9303122–, pp. 127-133) **Single-column data assimilation for the Atmospheric Radiation Measurement (ARM) Program.** Louis, J.F. (Atmospheric and Environmental Research, Inc., Cambridge, MA (United States)). USDOE Office of Energy Research, Washington, DC (United States). Mar 1994. From 3. Atmospheric Radiation Measurement (ARM) science team meeting; Norman, OK (United States); 1-5 Mar 1993. In *Proceedings of the third Atmospheric Radiation Measurement (ARM) science team meeting.* 379p. Source: OSTI; NTIS; INIS.

The main purpose of the ARM program is to provide the necessary data to develop, test and validate the parameterization of clouds and of their interactions with the radiation field, and the computation of radiative transfer in climate models. For various reasons, much of the ARM observations will be imperfect, incomplete, redundant, indirect and unrepresentative. Various techniques of data assimilation have been developed to deal with these problems. The variational data assimilation and adjoint method applied to a single column model is described here. A model is used to simulate the evolution of the atmosphere during an assimilation period. As the model is run, a cost function is computed which is essentially a measure of simulation errors. The method then consists in adjusting some model parameters to minimize the cost function. Optimization of the model parameters needs to be done with a much longer series of data, to cover different meteorological situations. Once parameters are set, nudging terms are used as control variables. The Derber nudging method will require considerable tuning, especially in defining the vertical profiles of the nudging terms. Extensive tests are currently underway of both model optimization and data assimilation.

28425 (CONF-9303122–, pp. 135-137) **Interactions between aerosols and clouds.** Toon, O.B. (Ames Research Center, Moffett Field, CA (United States)); Ackerman, A.; Jensen, E. USDOE Office of Energy Research, Washington, DC (United States). Mar 1994. From 3. Atmospheric Radiation Measurement (ARM) science team meeting; Norman, OK (United States); 1-5 Mar 1993. In *Proceedings of the third Atmospheric Radiation Measurement (ARM) science team meeting.* 379p. Source: OSTI; NTIS; INIS.

A number of studies have suggested that anthropogenic increases in aerosol production will alter the earth's climate. The change is due not only to the direct effect of the aerosols on the earth's radiation budget, but also to the indirect effects of aerosols on clouds. During the past few years we have been systematically examining the relations between changes in aerosol abundance and cloud properties with the goal of quantifying these interactions. Findings indicate that not all types of clouds respond in the same manner to changes in aerosol concentrations and that some hypotheses may be incorrect. By coupling a radiative transfer model to a microphysical cloud model and developing a one-dimensional turbulent transport model to represent boundary-layer dynamical processes, different cloud type responses can be simulated. The sensitivity of marine stratus, cirrus, and continental stratus cloud types are discussed.

28426 (CONF-9303122–, pp. 139-142) **Are ground-based measurements sufficient to quantify atmospheric radiative properties?.** Kinne, S. (NASA-Ames Research Center, Moffett Field, CA (United States)); Bergstrom, R.; Ackerman, T. USDOE Office of Energy Research, Washington, DC (United States). Mar 1994. From 3. Atmospheric Radiation Measurement (ARM) science team meeting; Norman, OK (United States); 1-5 Mar 1993. In *Proceedings of the third Atmospheric Radiation Measurement (ARM) science team meeting.* 379p. Source: OSTI; NTIS; INIS.

Radiation measurements at the surface and simultaneous ground-based measurements of the atmosphere during the FIRE'91 cirrus field experiment provided an opportunity to identify essential measurements and deficiencies in parameterization of current cloud-radiation models. Comparisons between measured and calculated broadband surface fluxes demonstrate the need for (1) accurate humidity and temperature vertical profiles, (2) data that capture the 3-dimensional structure and vertical extinction of clouds, and (3) additional airborne measurements. In-situ cloud microphysical measurements and radiation measurements near the tropopause (taken simultaneously to those at the surface, to define the radiative properties of the troposphere) are vital to improve radiative model parameterizations (and also satellite retrieval algorithms), which are used in the absence of available measurements.

28427 (CONF-9303122–, pp. 143-145) **Advances in the development of an integrated data assimilation and sounding system.** Dabberdt, W.F. (National Center for Atmospheric Research, Boulder, CO (United States)); Parsons, D.; Kuo, Y.H.; Dudhia, J.; Guo, Y.R.; Van Baelen, J.; Martin, C.; Oncley, S. USDOE Office of Energy Research, Washington, DC (United States). Mar 1994. From 3. Atmospheric Radiation Measurement (ARM) science team meeting; Norman, OK (United States); 1-5 Mar 1993.

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The Integrated Data Assimilation and Sounding System (IDASS) provides continuous high-resolution tropospheric profiles. The measurement system (Integrated Sounding System, or ISS) is developed around a suite of in situ and active and passive remote sensors. Observations from ISS networks provide a high-resolution description of atmospheric structure on the mesoscale. Measurements are coupled with a state-of-the-art mesoscale modeling system. The mesoscale data assimilation scheme is the Newtonian nudging technique. In the mesoscale data assimilation process, observations of wind, temperature, and humidity are used to nudge or relax the time-dependent model variables to the observed values. The end product is a highly resolved four-dimensional meteorological data set (including three components of wind, temperature, humidity, cloud water, and integrated moisture).

28428 (CONF-9303122–, pp. 147-150) **Modeling of clouds and radiation for development of parameterizations for general circulation models.** Westphal, D. (Ames Research Center, Moffett Field, CA (United States)); Toon, B.; Jensen, E.; Kinne, S.; Ackerman, A.; Bergstrom, R.; Walker, A. USDOE Office of Energy Research, Washington, DC (United States). Mar 1994. From 3. Atmospheric Radiation Measurement (ARM) science team meeting; Norman, OK (United States); 1-5 Mar 1993. In *Proceedings of the third Atmospheric Radiation Measurement (ARM) science team meeting.* 379p. Source: OSTI; NTIS; INIS.

Atmospheric Radiation Measurement (ARM) Program research at NASA Ames Research Center (ARC) includes radiative transfer modeling, cirrus cloud microphysics, and stratus cloud modeling. These efforts are designed to provide the basis for improving cloud and radiation parameterizations in our main effort: mesoscale cloud modeling. The range of non-convective cloud models used by the ARM modeling community can be crudely categorized based on the number of predicted hydrometers such as cloud water, ice water, rain, snow, graupel, etc. The simplest model has no predicted hydrometers and diagnoses the presence of clouds based on the predicted relative humidity. The vast majority of cloud models have two or more predictive bulk hydrometers and are termed either bulk water (BW) or size-resolving (SR) schemes. This study compares the various cloud models within the same dynamical framework, and compares results with observations rather than climate statistics.

28429 (CONF-9303122–, pp. 151-162) **The role of atmospheric radiation in the generation and maintenance of circulations of different scales.** Leach, M.J. (North Carolina State Univ., Raleigh, NC (United States)); Raman, S. USDOE Office of Energy Research, Washington, DC (United States). Mar 1994. From 3. Atmospheric Radiation Measurement (ARM) science team meeting; Norman, OK (United States); 1-5 Mar 1993. In *Proceedings of the third Atmospheric Radiation Measurement (ARM) science team meeting.* 379p. Source: OSTI; NTIS; INIS.

It is well known that the radiation budget of the atmosphere is an important component of the earth's climate system. On shorter time scales, radiative transfer affects the evolution of atmospheric circulation, principally through interaction with cloud and storm systems, and destabilizes the atmosphere continuously. This destabilization is important for subsequent development of clouds and storm systems. The clouds and storm systems feed back to the radiation budget, as clouds significantly alter both shortwave and longwave radiative transfer. It is important to understand the role that radiative transfer plays in the evolution of these circulation systems to accurately quantify the radiation budget. The results presented here are from modeling studies designed to isolate the effect of radiative transfer on the generation of circulation systems of different spatial and temporal scales. Two different numerical weather prediction models were used and will be described briefly in the next section. Following that, the radiative transfer model that was used with both circulation models will be described. Finally, results from the modeling studies will be presented, and conclusions and future research efforts will be discussed.

28430 (CONF-9303122–, pp. 163-169) **Vegetation forcing and thermally induced generation of mesoscale circulation.** Hong, X. (North Carolina State Univ., Raleigh, NC (United States)); Leach, M.J.; Raman, S. USDOE Office of Energy Research, Washington, DC (United States). Mar 1994. From 3. Atmospheric Radiation Measurement (ARM) science team meeting; Norman, OK (United States); 1-5 Mar 1993. In *Proceedings of the third Atmospheric Radiation Measurement (ARM) science team meeting.* 379p. Source: OSTI; NTIS; INIS.

Results indicate the effects of different surface characteristics, such as vegetation and bare soil heat capacity, on thermally induced mesoscale circulation. Vegetation increases water vapor flux in the boundary layer but decreases the sensible heat flux. Soils with different heat capacities after the transfer of heat fluxes to the atmosphere, affecting the PBL structure. Soils with smaller heat capacity transfer more sensible heat, producing more TKE, larger eddy diffusivity, and greater boundary layer heights. Results indicate that the same vegetation cover with different bare soil combinations changes the strength and size of the mesoscale circulation. In the future, we will extend the model to three dimensions, determine the effect of different soil covers and soil moisture on precipitation production, and couple the model with soil hydrology. We will use land use patterns from North Carolina and Oklahoma. These regions are two of the locals chosen for the U.S. Department of Energy's Atmospheric Radiation Measurement (ARM) Program. Observations from the 1991 and 1992 Boardman Regional Flux Experiment will also be used to validate the model. Effects of the resulting mesoscale circulation on the water budget, hydrology, and radiation budget will then be investigated.

28431 (CONF-9303122–, pp. 171-174) **Boundary-layer observations over the southern Great Plains cloud and radiation testbed site during the November flux-profiler test.** Oncley, S.P. (National Center for Atmospheric Research, Boulder, CO (United States)); Van Baelen, J. USDOE Office of Energy Research, Washington, DC (United States). Mar 1994. From 3. Atmospheric Radiation Measurement (ARM) science team meeting; Norman, OK (United States); 1-5 Mar 1993. In *Proceedings of the third Atmospheric Radiation Measurement (ARM) science team meeting.* 379p. Source: OSTI; NTIS; INIS.

In situ flux measurements were made to compare to the momentum flux profiler being designed for the ARM Program. About 10 hours of flux data were taken from an aircraft during the period November 12-17, 1992. The profiler was operated in Doppler beam swinging (DBS) mode while also processing the signal using interferometry. Radiosondes were launched from both the central facility and the flux-profiler site to provide measurements of wind, temperature, and humidity above the boundary layer for input to a mesoscale model and to provide an additional comparison for measurements made in the boundary layer.

28432 (CONF-9303122–, pp. 175-178) **Comparison of mesoscale model and tower measurements of surface fluxes during Winter Icing and Storms Program/Atmospheric Radiation Measurement 91.** Oncley, S.P. (National Center for Atmospheric Research, Boulder, CO (United States)); Dudhia, J. USDOE Office of Energy Research, Washington, DC (United States). Mar 1994. From 3. Atmospheric Radiation Measurement (ARM) science team meeting; Norman, OK (United States); 1-5 Mar 1993. In *Proceedings of the third Atmospheric Radiation Measurement (ARM) science team meeting.* 379p. Source: OSTI; NTIS; INIS.

This study is an evaluation of the ability of the Pennsylvania State University/National Center for Atmospheric Research (NCAR) mesoscale model (MM4) to determine surface fluxes to see if measured fluxes should be assimilated into model runs. Fluxes were compared from a high-resolution (5 km grid spacing) MM4 run during one day of the Winter Icing and Storms Programs/Atmospheric Radiation Measurement (WISP/ARM) experiment (over NE Colorado in winter 1991) with direct flux measurements made from a tower over a representative site by a three-dimensional sonic anemometer and fast response temperature and humidity sensors. This tower was part of the NCAR Atmosphere-Surface Turbulent Exchange Research (ASTER) facility. Also, mean values were compared to check whether any differences were due to the model parameterization or model variables.

28433 (CONF-9303122–, pp. 179-182) **A hierarchical approach to improved cloud radiation parameterization for climate models through the Atmospheric Radiation Measurement Program.** Kiehl, J.T. (National Center for Atmospheric Research, Boulder, CO (United States)); Moncrieff, M.W.; Hack, J.J.; Grabowski, W.; Ramaswamy, V. USDOE Office of Energy Research, Washington, DC (United States). Mar 1994. From 3. Atmospheric Radiation Measurement (ARM) science team meeting; Norman, OK (United States); 1-5 Mar 1993. In *Proceedings of the third Atmospheric Radiation Measurement (ARM) science team meeting.* 379p. Source: OSTI; NTIS; INIS.

Improved parameterization of clouds for general circulation models will require both ARM observations and the use of more detailed cloud models. The authors have adopted a parallel implementation approach to improve cloud parameterizations by including identical cloud radiative processes into three models that span the important spatial and temporal scales for cloud research. These models include a one-dimensional detailed ice microphysical model, the Clark cumulus ensemble model, and the Community Climate Model (CCM2) of the National Center for Atmospheric Research (NCAR). The first parallel development effort was to implement a column version of the CCM2 radiation model in the cirrus cloud model and the cumulus ensemble model. The same column model has also been implemented in the cloud microphysics model. The second effort was the introduction of explicit ice radiative properties into the shortwave and longwave radiative transfer model. The dependence of cirrus cloud radiative heating and longwave cooling on the ice particle size has been established as causing changes in zonally averaged temperature and zonal wind.

28434 (CONF-9303122–, pp. 183-184) **Development of a parameterization scheme of mesoscale convective systems.** Cotton, W.R. (Colorado State Univ., Fort Collins, CO (United States)). USDOE Office of Energy Research, Washington, DC (United States). Mar 1994. From 3. Atmospheric Radiation Measurement (ARM) science team meeting; Norman, OK (United States); 1-5 Mar 1993. In *Proceedings of the third Atmospheric Radiation Measurement (ARM) science team meeting.* 379p. Source: OSTI; NTIS; INIS.

The goal of this research is to develop a parameterization scheme of mesoscale convective systems (MCS) including diabatic heating, moisture and momentum transports, cloud formation, and precipitation. The approach is to: Perform explicit cloud-resolving simulation of MCSs; Perform statistical analyses of simulated MCSs to assist in fabricating a parameterization, calibrating coefficients, etc.; Test the parameterization scheme against independent field data measurements and in numerical weather prediction (NWP) models emulating general circulation model (GCM) grid resolution. Thus far we have formulated, calibrated, implemented and tested a deep convective engine against explicit Florida sea breeze convection and in coarse-grid regional simulations of mid-latitude and tropical MCSs. Several explicit simulations of MCSs have been completed, and several other are in progress. Analysis code is being written and run on the explicitly simulated data.

28435 (CONF-9303122–, pp. 185-186) **Development of a radiative cloud parameterization scheme of stratocumulus and stratus clouds which includes the impact of cloud condensation nucleus on cloud Albedo.** Cotton, W.R. (Colorado State Univ., Fort Collins, CO (United States)); Stephens, G.L.; Duda, D.; Stevens, B.; Walko, R.L.; Feingold, G. USDOE Office of Energy Research, Washington, DC (United States). Mar 1994. From 3. Atmospheric Radiation Measurement (ARM) science team meeting; Norman, OK (United States); 1-5 Mar 1993. In *Proceedings of the third Atmospheric Radiation Measurement (ARM) science team meeting.* 379p. Source: OSTI; NTIS; INIS.

A three-dimensional (3-D) model for simulating the effect of enhanced cloud condensation nucleus (CCN) concentrations on stratocumulus clouds is presented. Results of two-dimensional (2-D) tests are discussed for a control run and a sensitivity run where CCN spectra were taken to be typical of clean marine conditions or mildly continental air, respectively. For a fivefold increase in initial CCN concentrations, drop concentrations increased about threefold, effective radii decreased by 40%, while liquid water contents showed less significant variations. Estimates of effective radius and optical depth from the simulated cloud fields were derived by comparing the 2-D model reflectance functions with the reflectance functions obtained from independent pixel (IP) calculations for a range of effective radii and optical depths. In particular, the maximum differences in the IP-derived versus actual effective radius for the portions of the cloud with an optical depth greater than four ranged from 30% to 50% in both simulations. The domain-mean optical depth was underestimated by nearly 10%, while the maximum differences between the retrieved and actual optical depths were over 20%.

28436 (CONF-9303122–, pp. 187-193) **Regional climatology sensitivity studies.** Bossert, J.E. (Los Alamos National Laboratory, NM (United States)); Kao, C.Y.J.; Winterkamp, J.L.; Roads, J.O.; Chen, S.C. USDOE Office of Energy Research, Washington, DC (United States). Mar 1994. From 3. Atmospheric Radiation Measurement (ARM) science team meeting; Norman, OK (United States); 1-5 Mar 1993. In *Proceedings of the third Atmospheric Radiation Measurement (ARM) science team meeting.* 379p. Source: OSTI; NTIS; INIS.

Regional interest in understanding climate and climate change at regional scales has led to the application of mesoscale models for regional climatology studies. These models can provide an understanding of climate processes in a physically consistent way at much higher resolution than currently offered by general circulation models (GCMs). This paper presents results from two simple regional climate sensitivity experiments designed to test the impact of grid configuration on the prediction of precipitation. The simulated precipitation was first compared with observed data interpolated to model grid points. Assessing the accuracy of the modeling results is complicated by the fact that the mesoscale precipitation data set used for model validation is too sparse to provide a rigorous evaluation of the model's performance. The modeling results show that grid configuration must be given very careful consideration before a regional model can be implemented for climate studies over a particular area of interest. Results presented here suggest that seemingly minor changes in domain boundaries and grid resolution can have a dramatic impact upon predicted results.

28437 (CONF-9303122–, pp. 195-199) **Simulation of cloud/radiation interaction using a second-order turbulence radiative-convective model.** Kao, C.Y. (Los Alamos National Laboratory, NM (United States)); Smith, W.S. USDOE Office of Energy Research, Washington, DC (United States). Mar 1994. From 3. Atmospheric Radiation Measurement (ARM) science team meeting; Norman, OK (United States); 1-5 Mar 1993. In *Proceedings of the third Atmospheric Radiation Measurement (ARM) science team meeting.* 379p. Source: OSTI; NTIS; INIS.

Extended sheets of low-level stratus and stratocumulus clouds are a persistent feature over the eastern parts of the major ocean basins associated with the quasi-permanent subtropical high-pressure systems. These clouds exert a strong influence on climate through their high albedo, compared with the underlying surface, and their low altitude. The former leads to a reduction of the net shortwave flux entering the atmosphere, and the latter leads to an infrared loss in a way essentially the same as the cloud-free conditions. This paper is a modeling study with the current understanding of the important physical processes associated with a cloud-capped boundary layer. The numerical model is a high-resolution one-dimensional version of the second-order turbulence convective/radiative model developed at the Los Alamos National Laboratory. Future work includes sensitivity tests to ascertain the model validity as well as to systematically include all the possible ambient atmospheric and surface conditions. Detailed budget analyses are also useful in categorizing the cloud-capped boundary layers into a few classes.

28438 (CONF-9303122–, pp. 201-208) **Prognostic cloud water in the Los Alamos general circulation model.** Kristjansson, J.E. (Los Alamos National Laboratory, NM (United States)); Kao, C.Y.J. USDOE Office of Energy Research, Washington, DC (United States). Mar 1994. From 3. Atmospheric Radiation Measurement (ARM) science team meeting; Norman, OK (United States); 1-5 Mar 1993. In *Proceedings of the third Atmospheric Radiation Measurement (ARM) science team meeting.* 379p. Source: OSTI; NTIS; INIS.

Most of today's general circulation models (GCMs) have a greatly simplified treatment of condensation and clouds. Recent observational studies of the earth's radiation budget have suggested cloud-related feedback mechanisms to be of tremendous importance for the issue of global change. Thus, an urgent need for improvements in the treatment of clouds in GCMs has arisen, especially as the clouds relate to radiation. In this paper, we investigate the effects of introducing prognostic cloud water into the Los Alamos GCM. The cloud water field, produced by both stratiform and convective condensation, is subject to 3-dimensional advection and vertical diffusion. The cloud water enters the radiation calculations through the longwave emissivity calculations. Results from several sensitivity simulations show that realistic water and precipitation fields can be obtained with the applied method. Comparisons with observations show that the most realistic results are obtained when more sophisticated schemes for moist convection are introduced at the same time. The model's cold bias is reduced and the zonal winds becomes stronger because of more realistic tropical convection.

28439 (CONF-9303122–, pp. 209-212) **Factors influencing the parameterization of anvil clouds within general circulation models.** Leone, J.M. Jr. (Lawrence Livermore National Laboratory, CA (United States)); Chin, H.N. USDOE Office of Energy Research, Washington, DC (United States). Mar 1994. From 3. Atmospheric Radiation Measurement (ARM) science team meeting; Norman, OK (United States); 1-5 Mar 1993. In *Proceedings of the third Atmospheric Radiation Measurement (ARM) science team meeting.* 379p. Source: OSTI; NTIS; INIS.

The overall goal of this project is to improve the representation of clouds and their effects within global climate models (GCMs). We have concentrated on a small portion of the overall goal, the evolution of convectively generated cirrus clouds and their effects on the large-scale environment. Because of the large range of time and length scales involved, we have been using a multi-scale attack. For the early time generation and development of the cirrus anvil, we are using a cloud-scale model with horizontal resolution of 1 to 2 kilometers; for the larger scale transport by the larger scale flow, we are using a mesoscale model with a horizontal resolution of 20 to 60 kilometers. The eventual goal is to use the information obtained from these simulations, together with available observations, to derive improved cloud parameterizations for use in GCMs. This paper presents a new tool, a cirrus generator, that we have developed to aid in our mesoscale studies.

28440 (CONF-9303122–, pp. 213) **Modeling studies of the Indo-Pacific warm pool.** Barnett, T.P. (Scripps Institute of Oceanography, La Jolla, CA (United States)); Schneider N.; Tyree, M.; Ritchie, J.; Ramanathan, V.; Sherwood, S.; Zhang, G.; Flatau, M. USDOE Office of Energy Research, Washington, DC (United States). Mar 1994. From 3. Atmospheric Radiation Measurement (ARM) science team meeting; Norman, OK (United States); 1-5 Mar 1993. In *Proceedings of the third Atmospheric Radiation Measurement (ARM) science team meeting.* 379p. Source: OSTI; NTIS; INIS.

A wide variety of modeling studies are being conducted, aimed at understanding the interactions of clouds, radiation, and the ocean in the region of the Indo-Pacific warm pool, the flywheel of the global climate system. These studies are designed to understand the important physical processes operating in the ocean and atmosphere in the region. A stand alone Atmospheric GCM, forced by observed sea surface temperature, has been used for several purposes. One study with the AGCM shows the high sensitivity of the tropical circulation to variations in mid- to high-level clouds. A stand-alone ocean general circulation model (OGCM) is being used to study the relative role of shortwave radiation changes in the buoyancy flux forcing of the upper ocean. Complete studies of the warm pool can only be conducted with a full coupled ocean/atmosphere model. The latest version of the Hamburg CGCM produces realistic simulations of the ocean/atmosphere system in the Indo-Pacific without use of a flux correction scheme.

28441 (CONF-9303122–, pp. 215-219) **Cloud studies in climate research programs with 8-millimeter wavelength Doppler radar.** Kropfli, R.A. (Wave Propagation Laboratory, Boulder, CO (United States)); Matrosov, S.Y.; Uttal, T.; Orr, B.W. USDOE Office of Energy Research, Washington, DC (United States). Mar 1994. From 3. Atmospheric Radiation Measurement (ARM) science team meeting; Norman, OK (United States); 1-5 Mar 1993. In *Proceedings of the third Atmospheric Radiation Measurement (ARM) science team meeting.* 379p. Source: OSTI; NTIS; INIS.

NOAA's Wave Propagation Laboratory (WPL) operated a sensitive, 8-mm wavelength Doppler radar in three recent studies of clouds. Each experiment focused on cloud radiative and microphysical properties in order to improve cloud parameterizations in general circulation models. An overview of results from these experiments is presented to demonstrate the unique measurement capability of 8-mm wavelength radar. These methods are theoretically plausible and show good consistency with other remote sensing measurements. Nevertheless, they are still in need of extensive validation with in situ and other remote sensing observations before they become routinely usable by the general scientific community.

28442 (CONF-9303122–, pp. 221) **Parameterization of cirrus microphysical and radiative properties in larger-scale models.** Heymsfield, A.J. (National Center for Atmospheric Research, Boulder, CO (United States)); Coen, J.L. USDOE Office of Energy Research, Washington, DC (United States). Mar 1994. From 3. Atmospheric Radiation Measurement (ARM) science team meeting; Norman, OK (United States); 1-5 Mar 1993. In *Proceedings of the third Atmospheric Radiation Measurement (ARM) science team meeting.* 379p. Source: OSTI; NTIS; INIS.

This study exploits measurements in clouds sampled during several field programs to develop and validate parameterizations that represent the physical and radiative properties of convectively generated cirrus clouds in intermediate and large-scale models. The focus is on cirrus anvils because they occur frequently, cover large areas, and play a large role in the radiation budget. Preliminary work focuses on understanding the microphysical, radiative, and dynamical processes that occur in these clouds. A detailed microphysical package has been constructed that considers the growth of the following hydrometer types: water drops, needles, plates, dendrites, columns, bullet rosettes, aggregates, graupel, and hail. Particle growth processes include diffusional and accretional growth, aggregation, sedimentation, and melting. This package is being implemented in a simple dynamical model that tracks the evolution and dispersion of hydrometers in a stratiform anvil cloud. Given the momentum, vapor, and ice fluxes into the stratiform region and the temperature and humidity structure in the anvil's environment, this model will suggest anvil properties and structure.

28443 (CONF-9303122–, pp. 223-229) **Three-dimensional cloud characterization from paired whole-sky imaging cameras.** Allmen, M. (Sandia National Laboratories, Livermore, CA (United States)); Kegelmeyer, W.P. Jr. USDOE Office of Energy Research, Washington, DC (United States). Mar 1994. From 3. Atmospheric Radiation Measurement (ARM) science team meeting; Norman, OK (United States); 1-5 Mar 1993. In *Proceedings of the third Atmospheric Radiation Measurement (ARM) science team meeting.* 379p. Source: OSTI; NTIS; INIS.

Three-dimensional (3-D) cloud characterization permits the derivation of important cloud geometry properties such as fractional cloudiness, mean cloud and clear length, aspect ratio, and the morphology of cloud cover. These properties are needed as input to the hierarchical diagnosis (HD) and instantaneous radiative transfer (IRF) models, to validate sub-models for cloud occurrence and formation, and to Central Site radiative flux calculations. A full 3-D characterization will eventually require the integration of disparate Cloud and Radiation Testbed (CART) data sources: whole-sky imagers (WSIs), radar, satellites, ceilometers, volume-imaging lidar, and other sensors. In this paper, we demonstrate how an initial 3-D cloud property, cloud base height, can be determined from fusing paired times series of images from two whole-sky imagers.

28444 (CONF-9303122–, pp. 231-242) **Complex researches of tropospheric and stratospheric ozone performed at the Institute of Atmospheric Optics as a basis of a complete radiation experiment.** Zuev, V.V. (Institute of Atmospheric Optics, Tomsk (Russian Federation)). USDOE Office of Energy Research, Washington, DC (United States). Mar 1994. From 3. Atmospheric Radiation Measurement (ARM) science team meeting; Norman, OK

(United States); 1-5 Mar 1993. In *Proceedings of the third Atmospheric Radiation Measurement (ARM) science team meeting.* 379p. Source: OSTI; NTIS; INIS.

To describe the ozone cycle in the troposphere and stratosphere as a whole requires simultaneous information on a large number of gas trace species and aerosol and atmospheric meteorological parameters. In 1991 at the Institute of Atmospheric Optics, a long-term complex program on the investigation of stratospheric and tropospheric ozone, SATOR (Stratospheric and Tropospheric Ozone Research), was formulated. The program's primary objective is to perform a long-term complex experiment on the atmosphere by means of a large set of different devices located in one place and to analyze a long series of synchronous atmospheric observations obtained. The near-term objectives are to: Investigate the temporal variability of ozone concentration in the lower troposphere as a function of variability of the aerosol and gas composition of the atmospheric boundary layer, or as a function of the dynamics of the atmospheric boundary layer; and study the dynamics of the vertical distribution of stratospheric ozone and aerosol over Tomsk as well as investigate the microstructure of stratospheric aerosol and the relation between the variability of ozone and aerosol content in the stratosphere. Results of these observations are presented.

28445 (CONF-9303122–, pp. 243-249) **Theoretical studies of radiative properties of broken clouds.** Titov, G.A. (Russian Academy of Science, Tomsk (Russian Federation)). USDOE Office of Energy Research, Washington, DC (United States). Mar 1994. From 3. Atmospheric Radiation Measurement (ARM) science team meeting; Norman, OK (United States); 1-5 Mar 1993. In *Proceedings of the third Atmospheric Radiation Measurement (ARM) science team meeting.* 379p. Source: OSTI; NTIS; INIS.

One of the three goals of the Atmospheric Radiation Measurement (ARM) Program is to improve the quality of radiation models under clear sky, homogeneous cloud, and broken cloud conditions. This report is concerned with the development of the theory of radiation transfer in the broken clouds. Our approach is based on a stochastic description of the interaction between the radiation and cloud field with stochastic geometry; In the following, we discuss (1) the mean radiation fluxes in the near IR spectral range 2.7 to 3.2 μm; (2) the influence of random geometry of individual cumulus clouds on the mean fluxes of visible solar radiation; (3) the equations of the mean radiance in the statistically inhomogeneous cloud fields.

28446 (CONF-9303122–, pp. 251-261) **Radiation experiment in support of the Atmospheric Radiation Measurement Program.** Zuev, V.E. (Institute of Atmospheric Optics, Tomsk (Russian Federation)); Zuev, V.V.; Titov, G.A. USDOE Office of Energy Research, Washington, DC (United States). Mar 1994. From 3. Atmospheric Radiation Measurement (ARM) science team meeting; Norman, OK (United States); 1-5 Mar 1993. In *Proceedings of the third Atmospheric Radiation Measurement (ARM) science team meeting.* 379p. Source: OSTI; NTIS; INIS.

The objective of this work is to test and improve the radiation models under clear sky, homogeneous, and broken cloud conditions. The experiment will include measurements of the following characteristics of the radiation field and the parameters of the atmosphere-underlying surface system: Meteorological measurements; Atmospheric composition; Surface properties; Geometric structure of clouds; Radiation measurements. A unique instrumentation complex has been developed to measure a number of atmospheric parameters by several methods. This approach is important for intercalibration and increasing the reliability and the accuracy of the data obtained. The capabilities of the instrumentation including lidar, acoustic sensors, radiosondes, spectral photometers, and radiometers are briefly described.

28447 (CONF-9303122–, pp. 287-290) **Boundary layer heat budgets from wind profiler/radio acoustic sounding systems data: A feasibility study.** Furger, M. (Pacific Northwest Laboratory, Richland, WA (United States)); Whiteman, C.D. USDOE Office of Energy Research, Washington, DC (United States). Mar 1994. From 3. Atmospheric Radiation Measurement (ARM) science team meeting; Norman, OK (United States); 1-5 Mar 1993. In *Proceedings of the third Atmospheric Radiation Measurement (ARM) science team meeting.* 379p. Source: OSTI; NTIS; INIS.

Radar wind profilers (WP) and radio-acoustic sounding systems (RASS) are now available commercially and offer the promise of improving our knowledge of processes in the lower atmosphere on scales that were until now unresolved spatially and/or temporally. We re-evaluate some classical methods for the calculation of kinematic and dynamic quantities using measurements from these new remote sensing devices. In this paper, we restrict our study to the evaluation of the heat budget equation for the atmospheric volume dV defined by a triangular array of vertically pointing WP/RASS. Our goal is to determine the sensitivity of the heat budget calculations to WP/RASS wind and temperature measurement uncertainties. We conclude that atmospheric heat budget terms are rather strongly affected by present-day measurement uncertainties even under favorable weather conditions, although time and space averaging brings some improvement. The calculation method itself still has important shortcomings, however, which may prove unresolvable in practice. On the other hand, some of the terms in the budget equation, such as the time rate of change of heat storage, can be calculated with acceptably small error bars, thus opening the perspective of obtaining longer term, climatological statistics of quasi-continuous temperature and wind measurements in the atmospheric boundary layer.

28448 (CONF-9303122–, pp. 299-302) **Aerosol characterization using stellar imagery.** Weber, P.G. (Los Alamos National Laboratory, NM (United States)). USDOE Office of Energy Research, Washington, DC (United States). Mar 1994. From 3. Atmospheric Radiation Measurement (ARM) science team meeting; Norman, OK (United States); 1-5 Mar 1993. In *Proceedings of the third Atmospheric Radiation Measurement (ARM) science team meeting.* 379p. Source: OSTI; NTIS; INIS.

The objective of this project is to evaluate the feasibility of using perturbed stellar images (modified by atmospheric scattering and absorption) for characterizing atmospheric solid and liquid aerosols (particles and clouds). The baseline boundary conditions for the study included the potential use of one or more solid-state camera arrays for nighttime, multi-spectral observations. We begin by describing the rationale for aerosol measurements, including nighttime applications. We then describe a versatile Monte Carlo code that we have used to compute scattering by atmospheric aerosols. Several examples of applications of interest to the Atmospheric Measurement Radiation (ARM) Program will be briefly described. Finally, we present our conclusion: our computations indicated a limited applicability for stellar imagery in aerosol studies, requiring only relatively simple instrumentation.

28449 (CONF-9303122–, pp. 323-328) **The Tropical Western Pacific: Status report.** Ackerman, T. (Pennsylvania State Univ., University Park, PA (United States)); Barnes, F.J.; Clements, W.; Renne, D.; Westwater, E.R.; Barnett, T. USDOE Office of Energy Research, Washington, DC (United States). Mar 1994. From 3. Atmospheric Radiation Measurement (ARM) science team meeting; Norman, OK (United States); 1-5 Mar 1993. In *Proceedings of the third Atmospheric Radiation Measurement (ARM) science team meeting.* 379p. Source: OSTI; NTIS; INIS.

The Atmospheric Radiation Measurement (ARM) Program's Tropical Western Pacific (TWP) locale is the second of the five primary Cloud and Radiation Testbeds (CART) to be established. Phase implementation is currently planned to begin in 1994. The TWP locale encompasses an immense region of the tropical western Pacific bounded roughly by 10°N to 10°S extending eastward from Indonesia to somewhat east of the international dateline. Climatogically, it is characterized by warm sea surface temperatures, deep and frequent atmospheric convection, high rain rates, strong coupling between the atmosphere and ocean, and substantial variability associated with the El Nino-Southern Oscillation (ENSO) phenomenon. Any number of diagnostic studies can be cited that show the relationship between climatic variability in this region, particularly ENSO, and variability in other parts of the planet. Geographically, this locale is characterized by the maritime continent area in the southwest portion and essentially open ocean in the northeast portion. Details on the locale and the scientific challenges are presented in the proceedings of the second ARM Science Team meeting held in Denver in October 1991 (Clements

et al. 1992). The purpose of this paper is to report on activities since the 1991 Science Team meeting and discusses future plans.

28450 (CONF-9303122–, pp. 329-338) **VAS-derived cloud observations over the gulf stream locale during the winter months.** Alliss, R.J. (North Carolina State Univ., Raleigh, NC (United States)); Raman, S. USDOE Office of Energy Research, Washington, DC (United States). Mar 1994. From 3. Atmospheric Radiation Measurement (ARM) science team meeting; Norman, OK (United States); 1-5 Mar 1993. In *Proceedings of the third Atmospheric Radiation Measurement (ARM) science team meeting.* 379p. Source: OSTI; NTIS; INIS.

The objective of this study is to quantitatively evaluate the type and amount of cloudiness most present during the winter months (December - February). The principal finding is that the occurrence of clouds over the Gulf Stream Locale during the winter months is dependent on atmospheric processes and their likely interaction with the Gulf Stream. A cloud climatology consisting of seven winters indicates that clouds occur approximately 70% of the time. However, during periods of cold air outbreaks (CAO), cloudiness occurs much less frequently. From the limited number of analyzed CAO events, VAS observations indicate that the Gulf Stream Locale plays an important role in the formation and maintenance of clouds, particularly shallow, opaque clouds downwind of the Gulf Stream Locale. Future work will focus on isolating other atmospheric processes and their relationship to cloud production over the Gulf Stream Locale. In addition, diurnal effects of cloud distribution and the land, air-sea interaction process will be investigated and reported on in the future.

28451 (CONF-9303122–, pp. 339-340) **Scientific issues in the Gulf Stream locale.** Michael, P. (Brookhaven National Laboratory, Upton, NY (United States)); Daum, M.L.; Raman, S.; Leach, M. USDOE Office of Energy Research, Washington, DC (United States). Mar 1994. From 3. Atmospheric Radiation Measurement (ARM) science team meeting; Norman, OK (United States); 1-5 Mar 1993. In *Proceedings of the third Atmospheric Radiation Measurement (ARM) science team meeting.* 379p. Source: OSTI; NTIS; INIS.

Of the five primary CART sites, the Gulf Stream locale, a western boundary current location, uniquely experiences positive sensible and latent heat fluxes that span wide ranges and are likely the largest on earth. Scientific issues relating to this area are grouped under two objectives: (1) Relate observed instantaneous radiative properties of the atmosphere to the then-present atmospheric temperature and composition and surface radiative properties, both as a function of position, and develop parameterizations for these relationships. (2) Develop parameterizations to describe atmospheric composition and surface properties governing atmospheric radiation in terms of relevant prognostic variables, with the objective of incorporating these parameterizations into general circulation and related models.

28452 (CONF-9303122–, pp. 341-342) **Summary of combined heiarchical diagnosis and single-column model breakout session.** Randall, D.A. (National Center for Atmospheric Research, Boulder, CO (United States)); Kiehl, J.T.; Bradley, M. USDOE Office of Energy Research, Washington, DC (United States). Mar 1994. From 3. Atmospheric Radiation Measurement (ARM) science team meeting; Norman, OK (United States); 1-5 Mar 1993. In *Proceedings of the third Atmospheric Radiation Measurement (ARM) science team meeting.* 379p. Source: OSTI; NTIS; INIS.

This paper contains a summary of recommendations made for Intensive Operation Periods (IOPs) concerning advance notice and lead scientists for each IOP. June 1993, Fall 1993 and Spring 1994 activities were discussed. Recommendations were made concerning science team guidance for specific CART sites and the session concluded with a discussion of key scientific questions related to heiarchical diagnosis.

28453 (CONF-9303122–, pp. 349-351) **Surface aerosol measurements at Lamont, Oklahoma.** Leifer, R. (Environmental Measurements Laboratory, New York, NY (United States)); Knuth, R.; Lee, H.N. USDOE Office of Energy Research, Washington, DC (United States). Mar 1994. From 3. Atmospheric Radiation Measurement (ARM) science team meeting; Norman, OK (United States); 1-5 Mar 1993. In *Proceedings of the third Atmospheric Radiation Measurement (ARM) science team meeting.* 379p. Source: OSTI; NTIS; INIS.

In December of 1992 the ARM Aerosol Working Group prepared the document Priority Recommendations for Aerosol Measurements in the ARM program. A series of experiments was described to answer questions on the direct and indirect radiative effects of aerosols. The objectives of each of the experiments are reproduced and discussed here: (1) Compare direct and diffuse spectral shortwave surface radiative fluxes to those predicted by a model such as LOWTRAN to establish the errors and uncertainties in using a climatologically-averaged description of aerosols by air mass type included in such models. (2) Determine the errors and uncertainties in predicting surface radiative fluxes by a radiative transfer code that takes explicit cognizance of the aerosol scattering and absorptive properties. (3) Determine the error and uncertainties in the aerosol optical properties computed from measured chemical compositions and microphysical properties of aerosols.

28454 (CONF-9303122–, pp. 353-356) **Retrieval of three-dimensional cloud structure for estimating cloud-radiative forcing.** Shi, L. (Univ. of California, San Diego, CA (United States)); Corral, J. del; Ramanathan, V.; Boer, E. USDOE Office of Energy Research, Washington, DC (United States). Mar 1994. From 3. Atmospheric Radiation Measurement (ARM) science team meeting; Norman, OK (United States); 1-5 Mar 1993. In *Proceedings of the third Atmospheric Radiation Measurement (ARM) science team meeting.* 379p. Source: OSTI; NTIS; INIS.

The vertical structure of cloud-radiative heating plays an important role on the energy conversion and the dynamic structure of the atmosphere. To gain a better understanding of the three-dimensional cloud-radiative forcing field, a three-dimensional imaging algorithm has been developed to reconstruct the three-dimensional structure of clouds from satellite advanced very high resolution radiometer (AVHRR) measurements. The algorithm combines a spatial coherence technique with spectral variations in reflectivities to identify clear-sky and adopts a delta-Eddington technique to retrieve cloud optical depths. The algorithm is further refined in our current study. A discrete-ordinate radiative transfer model is used in this study to provide criteria for clear-sky detection and to obtain optical thickness from measured radiances. A prototype Atmospheric Radiation Measurement/Cloud and Radiation Testbed (ARM/CART) data set is employed to validate the cloud parameterization in the model. These data are provided by the Cloud Lidar and Radar Exploratory Test (CLARET) conducted in Boulder, Colorado, during September-October 1989. The data set contains surface radiation measurements, atmospheric sounding, and cloud observations.

28455 (CONF-9303122–, pp. 357-358) **Backward air mass trajectory analysis for the first cloud and radiation testbed site at Lamont, Oklahoma.** Lee, H.N. (Environmental Measurements Laboratory, New York, NY (United States)); Leifer, R. USDOE Office of Energy Research, Washington, DC (United States). Mar 1994. From 3. Atmospheric Radiation Measurement (ARM) science team meeting; Norman, OK (United States); 1-5 Mar 1993. In *Proceedings of the third Atmospheric Radiation Measurement (ARM) science team meeting.* 379p. Source: OSTI; NTIS; INIS.

The size distribution and composition of aerosols measured at a specific location depend on the origin and the trajectory of the air mass passing over it. Backward air mass trajectory analysis can be used to (1) identify the characteristics of an air mass and (2) help to determine which aerosol model should be used in LOWTRAN 7 for radiation calculations. Examining the trajectory is not sufficient to characterize the aerosol composition of the air mass at the site. Additional analyses must be performed along the trajectory to understand how the original air mass has or has not been modified. Height analyses, precipitation events, the vertical temperature structure of the atmosphere, and the relative humidity field, as well as other physical parameters, are important for classifying an air mass after it has traveled for a few days. The primary objective of this research is to characterize a climatology of air masses that pass over the Atmospheric Radiation Measurement (ARM) Program's Cloud and Radiation Testbed (CART) site at Lamont, Oklahoma. A three-dimensional air mass trajectory model and a

method of analysis were developed at the Environmental Measurements Laboratory (EML). The classification of the air mass types (rural, marine, urban or desert) is used to decide which aerosol model is appropriate for calculations in a radiation model, such as LOWTRAN 7.

28456 (CONF-9303122–, pp. 359-362) **The effect of network resolution on data assimilation in a mesoscale model.** Dudhia, J. (National Center for Atmospheric Research, Boulder, CO (United States)). USDOE Office of Energy Research, Washington, DC (United States). Mar 1994. From 3. Atmospheric Radiation Measurement (ARM) science team meeting; Norman, OK (United States); 1-5 Mar 1993. In *Proceedings of the third Atmospheric Radiation Measurement (ARM) science team meeting.* 379p. Source: OSTI; NTIS; INIS.

One goal of the Atmospheric Radiation Measurement (ARM) Program is to characterize meteorological fields over wide areas (200-km square) in order to better parameterize sub-grid-scale variability in general circulation models used for climate studies. Such a detailed knowledge over these areas is impossible with current observational methods alone, but the synthesis of a dataset by combining observations with a mesoscale numerical model is feasible. Current data assimilation techniques allow observed data to be incorporated while a model is running, thus constraining the model to fit the data as well as the data to be dynamically consistent with the model atmosphere. This interaction may therefore be regarded as a dynamical analysis technique. The technique used for data assimilation here will be the nudging method (Stauffer and Seaman 1990, Kuo and Guo 1989). Specifically, observational nudging where data at observational sites are gradually forced in the model without the need for a gridded analysis. This method is particularly appropriate for asynoptic data covering meso-β-scales, such as will be available at the Cloud and Radiation Testbed (CART) sites. The method makes it possible to incorporate the wide variety of data coming from these sites.

28457 (CONF-9303122–, pp. 363-366) **Radiation studies with a high-resolution mesoscale model.** Dudhia, J. (National Center for Atmospheric Research, Boulder, CO (United States)). USDOE Office of Energy Research, Washington, DC (United States). Mar 1994. From 3. Atmospheric Radiation Measurement (ARM) science team meeting; Norman, OK (United States); 1-5 Mar 1993. In *Proceedings of the third Atmospheric Radiation Measurement (ARM) science team meeting.* 379p. Source: OSTI; NTIS; INIS.

The paramaterization of radiation in general circulation models (GCMs) relies strongly on correctly representing the mean radiative properties over a typical grid size. The quality of the model's feedback between clouds and radiation would depend on the accuracy of this representation; this feedback is a key factor in determining the climate's behavior under various future scenarios. The use of a mesoscale model allows both clouds and radiation to receive a high-resolution treatment that can be free of the assumptions of overlapping and cloud fraction. To this end, the newest version of the Penn State/National Center for Atmospheric Research (NCAR) Mesoscale Model (MM5) has been upgraded to include a radiation package. Here the model is introduced and preliminary results are shown. Of particular interest are the domain-averaged properties of a cloud system as it evolves during one diurnal cycle.

28458 (CONF-9303122–, pp. 367-370) **Meso-Beta-Scale Data Assimilation of the Winter Icing and Storms Program/ Atmospheric Radiation Measurement Program 91 Intensive observing period case on 6 March 1991.** Kuo, Y.H. (National Cener for Atmospheric Research, Boulder, CO (United States)); Guo, Y.R. USDOE Office of Energy Research, Washington, DC (United States). Mar 1994. From 3. Atmospheric Radiation Measurement (ARM) science team meeting; Norman, OK (United States); 1-5 Mar 1993. In *Proceedings of the third Atmospheric Radiation Measurement (ARM) science team meeting.* 379p. Source: OSTI; NTIS; INIS.

To support the ARM program, we have proposed to develop an Integrated Data Assimilation and Sounding System (IDASS). The IDASS is composed of a measurement component and a modeling component. The measurement component (Integrated Sounding System or ISS) is developed around a suite of in situ and active and passive remote sensors. Individually, these sensors satisfy certain needs, together they function in a synergistic and complementary mode. The modeling component is an enhanced nonhydrostatic version of the Penn State/NCAR mesoscale model with data assimilation capability. The goal of IDASS is to provide continuous high-resolution tropospheric profiles of basic meteorological variables by continuous assimilation of measurements taken by ISS. The objectives of this study are (1) to assess the impact of mesoscale data assimilation on the model results, and (2) to evaluate the basic concept of IDASS.

28459 (CONF-9303122–, pp. 371-374) **Combined ground- and satellite-based profiling of temperature and water vapor.** Stankov, B.B. (Environmental Research Laboratories, Boulder, CO (United States)); Westwater, E.R.; Snider, J.B.; Churnside, J.H. USDOE Office of Energy Research, Washington, DC (United States). Mar 1994. From 3. Atmospheric Radiation Measurement (ARM) science team meeting; Norman, OK (United States); 1-5 Mar 1993. In *Proceedings of the third Atmospheric Radiation Measurement (ARM) science team meeting.* 379p. Source: OSTI; NTIS; INIS.

The fusion or integration of meteorological and radiative data from a range of instrumentation into a representative picture of temperature, water vapor, and clouds over a CART domain will be a challenging task for four-dimensional data assimilation models. In the work reported here, we have summarized work supported by DOE's algorithm development program including combined RASS and TIROS Operational Vertical Sounder (TOVS) temperature sensing, water vapor profiles from dual-channel radiometers, and neural network radiometric temperature retrievals.

28460 (DOE/ER/60372–9) **Recent changes of weather patterns in North America: Progress report for period ending April 1, 1994.** Kukla, G.J. (Columbia Univ., Palisades, NY (United States). Lamont-Doherty Earth Observatory); Karl, T. Columbia Univ., Palisades, NY (United States). Lamont-Doherty Earth Observatory. [1994]. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-85ER60372. Order Number DE94016115. Source: OSTI; NTIS; INIS; GPO Dep.

This report contains information dealing with climatic change in North America. Results gathered from present and previous DOE contracts are discussed. These include: usage of the Historical Climatology Network, characteristics of recent climate change, impacts of increasing anthropogenic greenhouse gases, seasonal trends, geographic and seasonal distribution of temperature anomalies, paleoclimates, weather pattern differences between eastern and western regions, daily temperature variations, general circulation models, and results of oceanic circulation.

28461 (DOE/NV/11432–139) **National emmission standards for hazardous air pollutants, Submittal – 1993.** Black, S.C. Reynolds Electrical and Engineering Co., Inc., Las Vegas, NV (United States). Jun 1994. 79p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC08-94NV11432. Order Number DE94016802. Source: OSTI; NTIS; INIS; GPO Dep.

This report discusses the effects on the environment caused by weapons testing at the Nevada Test Site. Topics include: emission of radionuclides into the air, atmospheric pumping of noble gases, tunnel operations, drillbacks, laboratories, radioactive waste management site, and plutonium contamination of surface areas.

28462 (EGG-CIET–11270) **Results of TSP metals monitoring at McMurdo Station, Antarctica.** Lugar, R.M. EG and G Idaho, Inc., Idaho Falls, ID (United States). Apr 1994. 22p. Sponsored by National Science Foundation, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE94015264. Source: OSTI; NTIS; GPO Dep.

This report presents the results of ambient air monitoring of metals in total suspended particulate (TSP) matter performed during the 1992–1993 austral summer at McMurdo Station, Antarctica. Seven samples of TSP were collected from three different locations and analyzed for arsenic, beryllium, cadmium, chromium, lead, nickel, and mercury. Critical-flow high-volume air samplers with a sample flow rate of approximately 1.1 m^3/minute were used to collect the particulate matter on quartz fiber filters for subsequent laboratory analysis. Sampling site selection, sampling procedures, and quality assurance procedures used were consistent with US

Environmental Protection Agency guidance for local ambient air quality networks. The data indicate that McMurdo operations have a measurable impact on the qualitative toxic metals composition of suspended particulate matter in the ambient air; however a definitive quantitative impact could not be concluded. The levels measured are well below the US National Ambient Air Quality Standards and American Conference of Governmental Industrial Hygienists worker exposure levels. Lead was the most prevalent of the seven toxic metals and was detected in all samples at concentrations ranging from 1.4 ng/m^3 to 38 ng/m^3. Data on the concentration of eleven other metal species are presented. Most notable was the relatively high abundance of titanium and copper, which were detectable at levels up to 2,100 ng/m^3 and 230 ng/m^3, respectively.

28463 (INIS-JP–019, pp. 136-144) **Recent trend of $\delta^{13}C$ of C4 plant cellulose as an indicator of atmospheric CO_2 change.** Minagawa, Masao (Mitsubishi Kasei Inst. of Life Sciences, Machida, Tokyo (Japan)); Egawa, Saho. Waseda Univ., Tokyo (Japan). 1993. 793p. (CONF-9203300–: International symposium on global change (IGBP), Tokyo (Japan), 27-29 Mar 1992). In *Proceedings: international symposium on global change (IGBP).* Order Number DE94765351. Source: OSTI; NTIS; INIS.

Natural carbon isotope composition ($^{13}C/^{12}C$) of C4 plant have been analyzed to trace the ^{13}C content of atmospheric carbon dioxide. Cellulose fraction, kernel coat and starch fraction were separated from two group of Zea mays (corn) which were grown and harvested at Hokkaido and Nagano prefecture in Japan during 1963 and 1989, and each component was analyzed for $^{13}C/^{12}C$ isotope ratios. The purpose of this study is to assess if these components are useful for tracing $^{13}C/^{12}C$ ratio of atmospheric CO_2 and how such isotopic composition of C4 plants can be modified from original isotopic signals of global circulating carbon. (author).

28464 (LITH-IFM-R–206) **The use of fourier transform combined with differential optical absorption technique to measure atmospheric pollutions.** Axelsson, L. Linkoeping Univ. (Sweden). Dept. of Physics and Measurement Technology. Mar 1994. 12p. Order Number DE94783402. Source: OSTI; NTIS.

To be presented at the '2nd European Conf. on Optical Chemical Sensors and Biosensors', Firenze (IT), Apr 1994.

In this paper, advantage is taken of the fact that the absorption spectra for several gases in the ultraviolet and visible spectral ranges are of periodic nature. Since any waveform that is a periodic function of time or distance can be sampled unambiguously using a minimum sampling frequency dependent on the frequency content of the periodic function, but always larger than or equal to twice the bandwidth of the system, the Nyquist criterion, we can calculate the concentration and separate different gases from each other with Fourier transform analysis. This method turns out to exhibit high sensitivity, good separation capacity, good accuracy and good robustness against wavelength displacements in the spectrum obtained. 4 refs, 12 figs

28465 (LITH-IFM-R–207) **Measurement of atmospheric pollutions with differential optical absorption technique combined with fourier transform.** Axelsson, L. Linkoeping Univ. (Sweden). Dept. of Physics and Measurement Technology. Mar 1994. 9p. Order Number DE94783403. Source: OSTI; NTIS.

To be presented at the '24th Int. Symp. on Environmental Analytical Chemistry', Ottawa (CA), May 1994.

In this paper, advantage is taken of the fact that the absorption spectra for ammonia, sulphur dioxide, nitrogen monoxide and nitrogen dioxide in the ultraviolet and visible spectral ranges are of periodic nature. Since any waveform that is a periodic function of time or distance can be sampled unambiguously using a minimum sampling frequency dependent on the frequency content of the periodic function, but always larger than or equal to twice the bandwidth of the system (the Nyquist criterion), we can calculate its concentration with Fourier transform analysis. This method turn out to exhibit high sensitivity, good separation capacity, good accuracy and good robustness against wavelength displacements in the spectrum obtained

28466 (NEI-DK–1578) **Danish air quality monitoring program annual data report 1992.** Kemp, K.; Manscher, O.H. Danmarks Miljoeundersoegelser, Roskilde (Denmark). Dec 1993. 59p. Order Number DE94783292. Source: OSTI; NTIS.

Cover title: Danish air quality monitoring program annual datareport 1992.

The third phase of the Danish Air Quality Monitoring Program (LMPIII) was started in 1992. The program comprise an urban monitoring network with stations in three Danish cities. The program is carried out in a cooperation between the National Agency of Environmental Protection, the National environmental Research Institute (NERI), the Greater Copenhagen Air Monitoring Unit and the municipal authorities in the cities of Odense and Aalborg. The results obtained during 1992 are, as far as sufficient data have been available, summarized in form of annual statistics and trends. Beside this the maximum concentrations (episodes) and the phenomenology of nitrogen oxides and ozone are treated as special topics because a new smog warning system will be implemented from 1994 and 1992 was the first year Ozone was included in the LMP program. The annual statistics and episodes are resumed for all groups of species. The results are compared with Danish limit values and WHO guideline values for SO_2, suspended particulate matter, NO_2 and Pb. Ozone is a new component in the monitoring program. Phenomenological descriptions are included for ozone and NO_x in order to illustrate the sources for and interaction between these species. The revised smog warming system is introduced from the beginning of 1994. The warning levels for NO_2 and SO_2 are unchanged in the new system. For both compounds warnings are given if the concentrations exceeds 350 μg/m^3 for more than three consecutive hours and no immediate decrease is expected. Beside the old compounds (NO_2 and SO_2) ozone is included in the new system. With reference to the directive EEC, 1992 a warning is broadcasted if the hourly mean concentration exceeds 180 μg/m^3, while an alarm is send to the population if the hourly mean concentration exceeds 360 μg/m^3. (EG) (15 refs.)

28467 (NUTEK-FJV–94-1) **Method for optimization of energy systems with regard to CO_2 emissions.** Berntsson, T. (Chalmers Industriteknik, Gothenburg (Sweden)); Aasblad, A. Swedish National Board for Industrial and Technical Development (NUTEK), Stockholm (Sweden). [1994]. 42p. (In Swedish). Project NUTEK 656-119. Order Number DE94783404. Source: OSTI; NTIS.

A method which identifies the most cost effective way of reducing CO_2-emission has been applied in the district heating system of the city of Alingsaas. The method makes it possible to identify the optimal mix of available production techniques which results in minimum emissions for a given total heat production cost. By increasing the allowed heat production cost in a step wise manner, the 'optimal' configuration changes and subsequently the total emissions. In this way an emission versus heating cost curve could be constructed which has definite endpoints. One endpoint is the cost minimum and its associated emissions and the other endpoint is when the production technique with the lowest specific emissions is maximized, without regard to heat production cost. 19 figs, 3 tabs

28468 (PNL-SA–23559) **An experimental and numerical study of the modifications of mixed-layer structure by inhomogeneous surface fluxes and secondary circulations.** Zhong, S.; Doran, J.C. Pacific Northwest Lab., Richland, WA (United States). Jul 1994. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. (CONF-940769–6: 6. conference on mesoscale processes, Portland, OR (United States), 18-22 Jul 1994). Order Number DE94015945. Source: OSTI; NTIS; GPO Dep.

The problem of scale interactions in the planetary boundary layer (PBL), i.e., how forcing mechanisms of differing spatial and temporal scales affect the properties of the PBL, has been a subject of considerable interest for some time. One aspect of this problem that has received increasing attention in recent years is the representation, in mesoscale and general circulation models. of the effects of subgrid-scale inhomogeneities in surface properties. Differences in sensible and latent heat fluxes between adjacent areas can result in secondary circulations. modifications to the boundary layer structure, and the transport of heat and moisture from one area to another. Despite their potential included on local PBL properties, such effects can not be resolved by numerical models

whose scale is too coarse; thus, suitable parameterizations that account for these phenomena are needed. In this paper the authors present some results of wind and temperature measurements over an area with significant variations in surface fluxes on scales of O(10 km). They then use fine resolution numerical simulations to show how synoptic, topographical, and thermal forcing combine to affect the properties of the PBL in the region. Specifically, they consider the relative importance of topography and land-use differences on the generation of secondary circulations and on the depth of the mixed layer, and they show how these effects are modified by synoptic wind fields. Implications for coarser resolution models are also discussed.

28469 (PNL-SA–24432) **Development and analysis of High-Energy Corona process for air purification.** Heath, W.O.; Barlow, S.E.; Bergsman, T.M.; Lessor, D.L.; Orlando, T.M.; Peurrung, A.J.; Shah, R.R. Pacific Northwest Lab., Richland, WA (United States). Jun 1994. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. (CONF-9406143–1: 1. international conference on advanced oxidation technologies for water and air remediation, London (Canada), 25-30 Jun 1994). Order Number DE94015207. Source: OSTI; NTIS; GPO Dep.

This paper gives an overview of the High-Energy Corona (HEC) technology being developed for treating air and other gas streams, summarizes results of an initial field test of the HEC process and follow-up laboratory experiments, and outlines the progress and approach toward better understanding of the underlying physical and chemical mechanisms to guide further development. The High-Energy Corona process uses high-voltage ac fields developed in a packed bed of dielectric pellets to form a nonequilibrium plasma in the void spaces between the pellets. The pellets refract the electric fields, creating extremely high field strengths capable of initiating electron-impact ionization of the air (and contaminants). The present-generation HEC device is a coaxial cylinder with an inner metal electrode, an outer tube made of glass, and dielectric pellets filling the annular gap. A metal foil or screen in contact with the outside surface of the tube serves as the ground electrode. The inner electrode is connected to a high-volume (25 to 30 kV) ac power supply operated at a fixed frequency of 60 Hz. The glass tube serves as the reaction vessel and as a dielectric barrier to inhibit direct charge transfer between electrodes. The gas to be treated is simply pulled through the packed bed where reactant species are produced and subsequent chemical reactions occur. Thus, far, the HEC process has been effective in destroying trichloroethylene, perchloroethylene, carbon tetrachloride, benzene, and heptane in the gas phase and naphthalene in the liquid phase. Further tests are planned with other compounds.

28470 (PNL-SA–24626) **Progress of revision to ANSI N13.1-1969 - guide to sampling airborne radioactive materials in nuclear facilities.** Glissmeyer, J.A. Pacific Northwest Lab., Richland, WA (United States). Jul 1994. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. (CONF-940738–3: 23. DOE/NRC nuclear air cleaning and treatment conference, Buffalo, NY (United States), 25-28 Jul 1994). Order Number DE94015734. Source: OSTI; NTIS; INIS; GPO Dep.

The ANSI N13.1-1969 Guide to Sampling Airborne Radioactive Materials in Nuclear Facilities is currently being revised. The revision is being drafted by a working group under the auspices of the Health Physics Society Standards Committee. The main differences between the original standard and the proposed revision are a narrowed scope, a greater emphasis on the design process, and the verification of meeting performance criteria. Compliance with the revised standard will present new challenges, especially in the area of performance validation. The progress made in the revision and key portions of the standard are discussed. The DOE has recently petitioned EPA for alternate approaches to complying with air-sampling regulations. Dealing with compliance issues until the revised standard is adopted will be a challenge for both designers and regulators.

28471 (RISO-R–755(EN)) **Design of the FLADIS field experiments with dispersion of liquefied ammonia.** Nielsen, M.; Bengtsson, R.; Jones, C.; Nyrøn, K.; Ott, S.; Ride, D. Risoe National Lab., Roskilde (Denmark). Meteorology and Wind Energy. Jun 1994. 55p. Contract CEC-EV5V-CT92-0069. Order Number DE94783299. Source: OSTI; NTIS; Also available from Risoe Library, P.O. Box 49, DK-4000 Roskilde, Denmark.

The objective of the Fladis field experiments is to investigate the dispersion of liquefied ammonia with equal attention to the near-source aerosol jet, the intermediate dense gas dispersion phase, and the far field passive dispersion phase. Two experimental campaigns have been conducted and a third one is planned. The data will be available to all interested parties and the present report provides the information necessary for the interpretation of the data. A description of the scope of the experiments, the experimental design, the applied instruments and the calibration methods is given. Few experimental results are presented - instead, MS-DOS based plotting and animation programs will be distributed with the data. (au) (23 tabs., 26 ills., 5 refs.)

28472 (SAND–94-0322) **PROJECT 56 in retrospect.** Jones, R.D.; Compton, M.L.; Hollister, J.F. Sandia National Labs., Albuquerque, NM (United States). May 1994. 38p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. Order Number DE94013816. Source: OSTI; NTIS; GPO Dep.

Nuclear weapons are designed to ensure that an accidental explosion will not result in a significant nuclear yield. In 1956 and again in 1960, a series of tests was conducted in the Coyote Test Field on Kirtland AFB to study the scattering of nuclear material from such an event. Simulated nuclear devices with depleted uranium were used in the tests.

28473 (SAND–94-8653C) **A laser-based technique for continuously monitoring metal emissions from thermal waste treatment units.** Flower, W.L.; Peng, L.W.; French, N.B.; Johnsen, H.A.; Ottesen, D.K. Sandia National Labs., Livermore, CA (United States). [1994]. 13p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. (CONF-940528–5: Incineration conference: 13th international symposium on thermal treatment technologies, Houston, TX (United States), 9-13 May 1994). Order Number DE94016619. Source: OSTI; NTIS; GPO Dep.

The authors describe the development of an advanced continuous emissions monitor for measuring metals contained in the effluent from thermal waste treatment units. The monitor is based on a measurement technique known as LAser-Spark-Spectroscopy (LASS), in which a focused pulsed laser is used to rapidly heat material contained in the focal region, producing a plasma (or laser "spark") that contains excited-state atoms and ions. Spectrally resolved measurements of optical emission from the plasma are used to identify and quantify the elements that are present. The LASS technique can measure atomic species embedded in solid or liquid aerosols, in addition to vapor-phase species. Thus, the technique is particularly well-suited for measuring metals in thermal-waste-treatment effluent, in which a large percentage of the metals are found in aerosol form. Experimental results presented here demonstrate that the LASS technique can be used to measure the eleven metals regulated under the Clean Air Act at levels typically permitted in the effluent from thermal waste treatment facilities. Measured detectability limits for these metals range from less than 0.1 μg/scm for beryllium to 250 μg/scm for lead. Also discussed are design considerations for a rugged, fieldable monitoring probe.

28474 (STUK-A–114) **Costs of radon mitigation in Finnish dwellings.** Arvela, H.; Castren, O. Finnish Centre for Radiation and Nuclear Safety (STUK), Helsinki (Finland). Feb 1994. 42p. (In Finnish). Order Number DE94632227. Source: OSTI; NTIS; INIS.

This study considers the mitigation methods and costs for dwellings exceeding the indoor radon concentration of 400 Bq/m^3. It is based on a 1990-91 radon survey of 3074 randomly chosen dwellings and also takes into account the results of special mitigation and air exchange studies. The number of dwellings exceeding the annual average radon concentration of 400 Bq/m^3 was 66 000: 59 000 low-rise residential houses and 7 000 flats. Subslab suction and radon wells prevent radon entry into houses and are the most effective methods. Typical radon reductions for these methods are 80-99% with properly designed installations. Ventilation techniques that reduce indoor radon concentrations were considered adequate if the air exchange rate is less than 0.25 H^{-1} and the radon

concentration less than 600 Bq m^{-3}. The estimated need for mitigation methods in low-rise houses was as follows: 40 000 subslab suction installations, 5 000 radon wells, 4 000 crawl space ventilation repairs, 4 000 basement ventilation repairs and 6 000 other repairs based on ventilation. The total cost of the programme was estimated at 445 million, the average cost for one dwelling is thus FIM 7 500, i.e. USD 1 250 (1 USD=FIM 6). The total cost would be FIM 500 million if the installations in blocs of flats were taken into account. The average annual operating costs were estimated at FIM 270. (orig.). (20 refs., 1 fig., 9 tabs.).

28475 (UCRL-JC–115076) **SCOPE-RADTEST: Radioactivity from nuclear test explosions.** Shapiro, C.S.; Tsaturov, Y. Lawrence Livermore National Lab., CA (United States). Oct 1993. 13p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-931063–1: International symposium on remediation and restoration of radioactive-contaminated sites in Europe, Antwerp (Belgium), 11-15 Oct 1993). Order Number DE94014749. Source: OSTI; NTIS; INIS; GPO Dep.

The SCOPE-RADTEST program consists of an international collaborative study involving Russia, the USA, China, and Kazakhstan. It will focus on the releases of radioactivity that resulted from nuclear test explosions that have taken place at various test sites around the world for peaceful and military purposes. RADTEST will focus on these principal tasks: (1) To inventory data on measurements of radionuclide deposition densities, and identify gaps in these data. (2) To compare old and develop new models of radioactive transport to better understand the deposition densities of radionuclides both on and near the nuclear test sites, including areas downwind where potentially significant episodes of fallout have occurred (such as the Altaj Region of Russia). (3) To study the migration of the radionuclides through the biosphere, including all pathways to humans. This will include the study of the effects on other biota that have impacts on humans. The main focus will be to characterize the nature and magnitude of the dose to humans. This will include dose reconstructions from past events, and also an increased capability for dose prediction from possible future accidental or deliberate explosions. (4)To analyze the data on the effects of these doses (including low doses) on human health. The test sites to be studied would include the Nevada Test Site (USA), South Pacific Islands (USA), Novaja Zemla (Russia), Semipalatinsk (Kazakhstan) and Luc Bu Pu (Lop Nor) (China). Tests at these sites include most of the total of nuclear explosions that have been conducted. Other sites, (including the sites of the U.K. and France), as appropriate, may also be included where tests were conducted for peaceful or military purposes.

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Refer also to citation(s) 27201, 27266, 27309, 27310, 27311, 27313, 27314, 27316, 27319, 27320, 27322, 27323, 27325, 27328, 27337, 27338, 27373, 27376, 27392, 27404, 27440, 27441, 27442, 27443, 27447, 27451, 27453, 27454, 27455, 27460, 27464, 27465, 27466, 27469, 27476, 27477, 27484, 27491, 27494, 27497, 27501, 27508, 27514, 27517, 27518, 27519, 27525, 27527, 27528, 27805, 27867, 27984, 28328, 28345, 28398, 28400, 28460, 28474, 28916, 28926, 28928, 28961, 28969

28476 (ANL/CMT/CP–82156) **Characterization studies of actinide contamination on Johnston Atoll.** Wolf, S.F.; Bates, J.K.; Brown, N.R.; Buck, E.C.; Dietz, N.L.; Fortner, J.A.; Gong, Meiling. Argonne National Lab., IL (United States). [1994]. 7p. Sponsored by Department of Defense, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-940815–65: International nuclear and hazardous waste management conference, Atlanta, GA (United States), 14-18 Aug 1994). Order Number DE94015087. Source: OSTI; NTIS; INIS; GPO Dep.

This paper presents results that indicates that plutonium and americium contamination of Johnson Atoll soil and sludge from the cleanup plant settling pond is dispersed. The $^{241}Am/^{239}Pu$ ratio was essentially identical for all analyzed material. Except for one "hot particle," no discrete Pu particles were located in untreated coral soil by SEM even though our sample contained both ^{241}Am and ^{239}Pu activity measurable by gammaray spectrometry. Alpha particle spectrometry analysis of sequentially filtered sludge showed small that activity is associated with particles as 0.4 μm in diameter. Thin section analysis revealed that the "hot particle" was a fragment of stainless steel with a layer of oxidized Pu, U, and other metals deposited on the outside. This Pu-containing layer was covered with a layer of coral soil that formed on the oxidized Pu/U phase during the process of weathering on JA. Analyses of all samples except the "hot particle" with SEM or TEM coupled with EDS did not reveal the presence of any distinct Pu phases, despite measurable activity in these samples. Together, these findings are consistent with the Pu and Am being highly dispersed throughout the contaminated soil and sludge. Direct evidence for association of Pu with coral was observed in the thin section of the "hot particle." A possible mechanism for the dispersal of contamination is that weathering of fragments from the aborted missile leads to complexation of Pu with calcium carbonate followed by adsorption onto the coral soil surface. This process has not led to measurable fractionation of Am from its Pu parent.

28477 (ANL/ER/CP–81599) **The effects of emission of anthropogenic chemical species on chemical and physical properties of aerosols.** Lee, In Young. Argonne National Lab., IL (United States). [1994]. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-940812–13: 29. intersociety energy conversion engineering conference, Monterey, CA (United States), 7-12 Aug 1994). Order Number DE94015061. Source: OSTI; NTIS; GPO Dep.

Numerical studies have been carried out to examine the effects of chemically reactive trace gases emitted into the atmosphere on the evolution of chemical species concentrations, on the chemical composition and size distribution of airborne particles, and on optical properties of aerosols. Argonne's chemistry module has been modified by refining the treatment of gas-to-particle conversion. The changes in size distribution and chemical composition of aerosols are calculated with consideration of heteramolecular diffusion and coagulation. Results of the 24 h real-time simulation indicate that the maximum oxidation rate of sulfur dioxide is about 0.4% h^{-1}; that the total aerosol volume increases with the increase in relative humidity by as much as 36% (due mainly to the collection of sulfuric acid embryos by preexisting particles); and that the surface area, a measure of optical depth, increases with the increase in relative humidity by as much as 27%.

28478 (ANL/ER/TM–3) **Performance specifications for technology development: Application for characterization of volatile organic compounds in the environment.** Carpenter, S.E.; Doskey, P.V.; Erickson, M.D.; Lindahl, P.C. Argonne National Lab., IL (United States). Jul 1994. 109p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. Order Number DE94016627. Source: OSTI; NTIS; GPO Dep.

This report contains information about technology development for the monitoring and remediation of environmental pollution caused by the release of volatile organic compounds. Topics discussed include: performance specification processes, gas chromatography, mass spectrometer, fiber-optic chemical sensors, infrared spectroscopy, Raman spectroscopy, piezoelectric sensors and electrochemical sensors. These methods are analyzed for their cost efficiency, accuracy, and the ability to meet the needs of the customer.

28479 (ANL/ES/CP–82473) **Uptake of explosives from contaminated soil by vegetation at the Joliet Army Ammunition Plant.** Schneider, J.F. (Argonne National Lab., IL (United States)); Tomczyk, N.A.; Zellmer, S.D.; Banwart, W.L.; Houser, W.P. Argonne National Lab., IL (United States). Jun 1994. 9p. Sponsored by Department of Defense, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-9406213–1: 18. annual army environmental R&D symposium, Williamsburg, VA (United States), 28-30 Jun 1994). Order Number DE94015066. Source: OSTI; NTIS; INIS; GPO Dep.

This study examines the uptake of explosives by vegetation growing on soils contaminated by 2,4,6-trinitrotoluene (TNT) in Group 61 at the Joliet Army Ammunition Plant (JAAP). Plant materials and soil from the root zone were sampled and analyzed to determine TNT uptake under natural field conditions. Standard USATHAMA methods were used to determine concentrations of explosives, their derivatives, and metabolites in the soil samples. No-

explosives were detected in the aboveground portion of any plant sample. However, results indicate that TNT, 2-aminodinitrotoluene (2-ADNT), and/or 4-ADNT were present in some root samples. The presence of 2-ADNT and 4-ADNT increases the likelihood that explosives were taken up by plant roots, as opposed to their presence resulting from external soil contamination.

28480 (DOE/EA–0904) **Access road from State Route 240 to the 200 West Area, Hanford Site, Richland, Washington: Environmental assessment.** USDOE, Washington, DC (United States). Feb 1994. 48p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE94015333. Source: OSTI; NTIS; GPO Dep.

The US Department of Energy (DOE) proposes to construct an access road on the Hanford Site, from State Route (SR) 240 to Beloit Avenue in the 200 West Area. Traffic volume during shift changes creates an extremely serious congestion and safety problem on Route 4S from the Wye barricade to the 200 Areas. A Risk Evaluation (Trost 1992) indicated that there is a probability of 1.53 fatal accidents on Route 4S within 2 years. To help alleviate this danger, a new 3.5-kilometer (2.2-mile)-long access road would be constructed from Beloit Avenue in the 200 West Area to SR 240. In addition, administrative controls such as redirecting traffic onto alternate routes would be used to further reduce traffic volume. The proposed access road would provide an alternative travel-to-work route for many outer area personnel, particularly those with destinations in the 200 West Area. This proposal is the most reasonable alternative to reduce the problem. While traffic safety would be greatly improved, a small portion of the shrub-steppe habitat would be disturbed. The DOE would offset any habitat damage by re-vegetation or other appropriate habitat enhancement activities elsewhere on the Hanford Site. This Environmental Assessment (EA) provides information about the environmental impacts of the proposed action, so a decision can be made to either prepare an Environmental Impact Statement or issue a Finding of No Significant Impact.

28481 (DOE/EA–0907) **Idaho National Engineering Laboratory Sewer System Upgrade Project: Environmental Assessment.** USDOE Idaho Operations Office, Idaho Falls, ID (United States). Apr 1994. 32p. Sponsored by USDOE, Washington, DC (United States). Order Number DE94015407. Source: OSTI; NTIS; GPO Dep.

The Department of Energy (DOE) has prepared an environmental assessment for a proposed Sewer System Upgrade Project at the Idaho National Engineering Laboratory (INEL) near Idaho Falls, Idaho. The proposed action would include activities conducted at the Central Facilities Area, Test Reactor Area, and the Containment Test Facility at the Test Area North at INEL. The proposed action would consist of replacing or remodeling the existing sewage treatment plants at the Central Facilities Area, Test Reactor Area, and Containment Test Facility. Also, a new sewage testing laboratory would be constructed at the Central Facilities Area. Finally, the proposed action would include replacing, repairing, and/or adding sewer lines in areas where needed.

28482 (DOE/EA–0943) **Environmental assessment for the domestic water supply upgrades and consolidation on the Savannah River Site.** USDOE Savannah River Operations Office, Aiken, SC (United States). Jun 1994. 32p. Sponsored by USDOE, Washington, DC (United States). Order Number DE94015403. Source: OSTI; NTIS; INIS; GPO Dep.

The domestic water systems on the Savannah River Site (SRS) are currently in need of upgrading to ensure compliance with the Safe Drinking Water Act and South Carolina Department of Health and Environmental Control (SCDHEC) Drinking Water Regulations. The SRS has 28 separate goundwater-based drinking water systems in use across the site. These aging systems were designed and constructed in the 1950s and are now facing increasing difficulties in meeting cur-rent regulations. Audits of the systems conducted by SCDHEC in 1986, 1988, 1991, and 1993 identified shortfalls in meeting the requirements for secondary maximum containment levels (MCLS) and SCDHEC design standards. Secondary MCLs are those items, such as odor or appearance, that do not pose a direct health impact. SRS has committed to SCDHEC to correct the drinking water discrepancies and construct two new consolidated inter-area drinking water systems. Upgrading the SRS drinking water systems would be necessary to support site activities regardless of the makeup or the mission at SRS. As such, the proposed upgrade and consolidation of SRS domestic water systems is treated as part of the "No Action" alternative for the Programmatic Environmental Impact Statement for Reconfiguration of the Nuclear Weapons Complex .

28483 (DOE/ER/14328–1) **HRTEM investigations between minerals, fluids and lithobiontic communities during natural weathering: Progress report, September 1, 1993–February 28, 1994.** Banfield, J.F.; Barker, W.W. Wisconsin Univ., Madison, WI (United States). Dept. of Geology and Geophysics. Feb 1994. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-93ER14328. Order Number DE94015668. Source: OSTI; NTIS; GPO Dep.

HRTEM and AEM analysis of riebeckite and acmite from the interiors of moderately weathered syenite reveals that interaction of these minerals with surficial fluids resulted in the almost complete removal of Na, Ca, and Si. Fe remained relatively immobile, forming arrays of semi-oriented nanocrystalline ferrihydrite and goethite at the primary mineral-secondary mineral interface. The goethite intimately contacts an irregularly corroded amphibole surface. Smectite occurs sporadically as isolated crystallites a few layers thick which are surrounded by goethite. No obvious structural alignment between clay and amphibole or pyroxene was seen. Data suggest that almost all Si is transported in solution to more open regions between islands of nanocrystalline goethite, where it crystallizes as an Fe - rich smectite. Alteration assemblages in wider channels are comprised of euhedral goethite crystals that, within a submicron-sized area, range in size from 5–40 manometers. Subgrain boundary structures and the porosity distribution suggests evolution of particle size by coarsening. Optical microscopy demonstrates intimate contact between lichen thalli and mineral surfaces. Lichen thalli exploit cracks and open cleavages to extend several millimeters within mineral interiors. Preliminary TEM data suggest the alteration assemblage consists of a polymer-bound mass of chemically complex aluminosilicates.

28484 (DOE/ER/61484–08) **Small scale laboratory studies of flow and transport phenomena in pores and fractures: Phase II: Progress report, 3rd year continuation proposal, and work plan.** Wilson, J.L. New Mexico Inst. of Mining and Technology, Socorro, NM (United States). May 1994. 13p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG03-92ER61484. Order Number DE94017149. Source: OSTI; NTIS; GPO Dep.

Small scale laboratory experiments, equipped with an ability to actually observe behavior on the pore level using microscopy, provide an economical and easily understood scientific tool to help us validate concepts and assumptions about the transport of contaminants, and offers the propensity to discover heretofore unrecognized phenomena or behavior. The main technique employs etched glass micromodels, composed of two etched glass plates, sintered together, to form a two dimensional network of three dimensional pores. Flow and transport behavior is observed on a pore or pore network level, and recorder on film and video tape. This technique is coupled with related column studies. These techniques have been used to study multiphase flow, colloid transport and most recently bacteria transport. The project has recently moved to the Bacteria Transport Subprogram, and efforts have been redirected to support that Subprogram and its collaborative field experiment. We proposed to study bacteria transport factors of relevance to the field experiment, using micromodels and other laboratory techniques. Factors that may be addressed include bacteria characteristics (eg, hydrophobicity), pore size and shape, permeability heterogeneity, surface chemistry (eg, iron oxide coatings), surface chemistry heterogeneity, active versus resting cell bacteria, and mixed bacteria populations. In other work we will continue to examine the effects of fluid-fluid interfaces on bacteria transport, and develop a new assay for bacteria hydrophobicity. Finally we will collaborate on characterization of the field site, and the design, operation, and interpretation of the field experiment.

28485 (DOE/ID/12735–T31) **Projects at the Component Development and Integration Facility: Quarterly technical**

progress report, January 1, 1994–March 31, 1994. MSE, Inc., Butte, MT (United States). [1994]. 27p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC22-88ID12735. Order Number DE94017038. Source: OSTI; NTIS; GPO Dep.

This quarterly technical progress report presents progress on the projects at the Component Development and Integration Facility (CDIF) during the second quarter of FY94. The CDIF is a major US Department of Energy test facility in Butte, Montana, operated by MSE, Inc. Projects in progress include: Biomass Remediation Project; Heavy Metal-Contaminated Soil Project; MHD Shutdown; Mine Waste Technology Pilot Program; Plasma Projects; Resource Recovery Project; Sodium Sulfide/Ferrous Sulfate Project; and Spray Casting Project.

28486 (DOE/NV/10845–38) **Archaeological data recovery for sample unit U19ao Pahute Mesa, Nye County, Nevada.** Drollinger, H. Nevada Univ., Las Vegas. NV (United States). Desert Research Inst. 1993. 295p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC08-90NV10845. Order Number DE94015656. Source: OSTI; NTIS; INIS; GPO Dep.

This report presents the procedures and findings of the archaeological data recovery for sample unit U19ao on Pahute Mesa of the Nevada Test Site. Four sites were investigated. The first is multicomponent, consisting of prehistoric and historic surface features and artifacts in an upland valley. A silicified volcanic toolstone quarry is also present. The second is a rockshelter that has revealed temporal variation ranging from the Middle Archaic to the Historic. The site contains perishable items not normally preserved in the archaeological record for Pahute and Rainier mesas. The other two are silicified volcanic toolstone quarries in a narrow valley to the west. Data recovery for the sites consisted of surface collection, test excavations, surface scrapes, and full-scale excavation. Research questions concerning spatial analysis, raw material sources, lithic technology, and settlement and mobility patterns are addressed. Artifacts and features range from the Early Archaic to the present, representing about 10,000 years of cultural history. The research tends to support previous statements of increased use of mountain resources through time and interaction with groups outside the Great Basin in the later periods. In addition, the settlement and mobility pattern on Pahute Mesa appears to shift through time, with primarily hunting, and possibly exploration, during the Early Archaic, of hunting and foraging of different resources in the Middle Archaic, to a logistically-oriented practice for the Late Archaic and Shoshonean periods. Relatively permanent camps appear to have been established during the later periods as noted by the presence of ceramics and groundstone and increased activities at two sites. Rock features appear to date to this time as well. Historic occupations are most likely associated with ranching activities. 203 refs., 57 figs., 49 tabs.

28487 (DOE/SR/15199–17) **Intensive archaeological survey of the proposed Savannah River Ecology Laboratory Conference Center and Educational Facility, Savannah River Site, Aiken County, South Carolina.** Technical report series Number 17. Stephenson, K.; Crass, D.C.; Sassaman, K.E. South Carolina Univ., Columbia, SC (United States). Savannah River Archaeological Research Program. Feb 1993. 111p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FC09-88SR15199. Order Number DE94016173. Source: OSTI; NTIS; GPO Dep.

Documented in this report are the methods and results of an intensive archaeological survey for the proposed University of Georgia Savannah River Ecology Laboratory (SREL) Conference Center and Educational Facility on the DOE Savannah River Site (SRS). Archaeological investigations conducted by the Savannah River Archaeological Research Program (SRARP) on the 70-acre project area and associated rights-of-way consisted of subsurface testing at two previously recorded sites and the discovery of one previously unrecorded site. The results show that 2 sites contain archaeological remains that may yield significant information about human occupations in the Aiken Plateau and are therefore considered eligible for nomination to the National Register of Historic Places. Adverse impacts to these sites can be mitigated through avoidance.

28488 (EGG–11265-1012) **An aerial radiological survey of the southwest drainage basin area of the Savannah River Site.** Feimster, E.L. EG and G Energy Measurements, Inc., Las Vegas, NV (United States). Apr 1994. 28p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC08-93NV11265. Order Number DE94016772. Source: OSTI; NTIS; INIS; GPO Dep.

An aerial radiological survey was conducted over a 106-square-mile area of the Savannah River Site (SRS), formerly the Savannah River Plant. The survey was conducted from August 24 through September 8, 1988, to collect baseline radiological data over the area. Both natural and man-made gamma emitting radionuclides were detected in the area. The detected man-made sources were confined to creeks, branches, and SRS facilities in the surveyed area and were a result of SRS operations. Naturally-occurring radiation levels were consistent with those levels detected in adjacent areas during previous surveys. The annual dose levels were within the range of levels found throughout the United States.

28489 (EGG–11265-2022) **Effects of gravel mulch on emergence of galleta grass seedlings: Oral summary report.** Winkel, V.K.; Medrano, J.C.; Stanley, C.; Walo, M.D. EG and G Energy Measurements, Inc., Las Vegas, NV (United States). Mar 1993. 35p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC08-93NV11265. (CONF-9310276–Summ.: 8. wildland shrub and arid land restoration symposium, Las Vegas, NV (United States), 19-21 Oct 1993). Order Number DE94013545. Source: OSTI; NTIS; INIS; GPO Dep.

The Department of Energy Nevada Operations Office, Technology Development and Program Management Division, has identified the need to clean up several sites on the Nevada Test Site and Tonopah Test Range contaminated with surface plutonium. An important objective of the project identified as the Plutonium In Soils Integrated Demonstration is to develop technologies to stabilize and restore the disturbed sites after decontamination. Revegetation of these contaminated sites will be difficult due to their location in the arid Mojave and Great Basin Deserts. The major factors which will affect successful plant establishment and growth at these sites are limited and sporadic precipitation, limited soil water, extreme air and soil temperatures, limited topsoil, and herbivory . Research has shown that providing microsites for seed via mulching can aid in plant emergence and establishment. Since many of the soils at the sites slated for plutonium decontamination have a large percentage of gravel in the upper 10 cm of soil, the use of gravel as mulch could provide microsites for seed and stabilize soils during subsequent revegetation of the sites. In July 1992, EG&G/EM Environmental Sciences Department initiated a greenhouse study to examine the possible benefits of gravel mulch. The specific objectives of this greenhouse study were to: (1) determine the effects seedling emergence and soil water, and (2) determine effects of irrigation rates on seedling emergence for gravel mulches and other conventional seedbed preparation techniques. A secondary objective was to determine the depth of gravel mulch that was optimal for seedling emergence. Results from this greenhouse study will assist in formulating specific reclamation plans for sites chosen for cleanup.

28490 (EGG–11265-2059) **Effects of supplemental feeding on survivorship, reproduction, and dispersal in San Joaquin kit foxes.** EG and G Energy Measurements, Inc., Goleta, CA (United States). Santa Barbara Operations. Feb 1993. 30p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC08-93NV11265. Order Number DE94016798. Source: OSTI; NTIS; GPO Dep.

Previous field studies at the Naval Petroleum Reserves in California indicated that a decline in tie population size of the endangered San Joaquin kit fox might be linked to declining prey abundance. To evaluate whether kit fox populations we limited by food resources; survival probabilities, sources of mortality, reproductive success, and dispersal rates were compared between foxes with access to supplemental food and foxes without access to supplemental food (controls). Of foxes born in 1988, the probabilities of supplementary fed foxes surviving to age one and age two were higher than corresponding probabilities of control foxes. Survival probabilities of fed foxes from the 1988 cohort also were higher than the average survival probabilities of foxes born in the previous eight years. Most foxes that died during their first year of life died in June, July, or August. Monthly probabilities of survival

were higher for fed pups than control pups curing the months of July and August of 1988. Survival probabilities of fed foxes originally r captured as adults and fed foxes born in 1989 were not significantly different than survival probabilities of corresponding control groups. Most foxes for which a cause of death could be determined were lolled by predators. Average dispersal distances were not significantly different between fed and control groups but the two longest dispersal distances were made by control foxes. These results indicate that food availability affects survival, reproduction, and dispersal by kit foxes and provides evidence that kit fox populations may at times be limited by food abundance.

28491 (JAERI-M–94-065) **HTO emission from contaminated surfaces and distribution in the environmental media. 1: Summary of data collected during field study in Canada in july 1992.** Murata, Mikio (Japan Atomic Energy Research Inst., Tokai, Ibaraki (Japan). Tokai Research Establishment); Kinouchi, Nobuyuki; Yokoyama, Sumi. Japan Atomic Energy Research Inst., Tokyo (Japan). Mar 1994. 102p. Order Number DE94785242. Source: OSTI; NTIS; INIS.

HTO emission from contaminated land surfaces and distribution in the environmental media were studied to provide databases for testing and validating short-range tritium transfer models. Field experiments were conducted over a wetland area in the Chalk River Laboratories of AECL and a grassed field near the Pickering Nuclear Generating Station, under an OECD/IEA Cooperative Research Program on the Environmental, Safety and Economic Aspects of Fusion Power. The experiments were designed to study short-term variations of HTO concentrations in the environmental media such as air, soil, plant leaves and pool water and correlations between them, to measure vertical profiles of the air HTO concentrations and to evaluate exchange velocities of HTO vapor between land surfaces and the atmosphere. Meteorological measurement was also made to back up data analysis. This report documents the HTO concentration data collected during an intensive study on HTO behavior with a brief discussion and analysis and the meteorological data. (author).

28492 (K/TCD–1111) **Technical support for the Soiltech soil washing project: Interim report.** Tomascik, T.S. Oak Ridge K-25 Site, TN (United States). Aug 1994. 40p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE94016531. Source: OSTI; NTIS; INIS; GPO Dep.

The organic removal ability of a surfactant solution was studied for an "as-received" soil sample. A 15% surfactant solution was added to an equal portion of the soil sample, by volume, and blended. The mixture was then stirred with a magnetic stirrer. A black precipitate resulted, which was then periodically skimmed off the top of the solution. This was done at both room temperature and at 150°F. The soil sample was examined before and after processing with optical microscopy, environmental scanning electron microscopy (ESEM) , energy dispersive x-ray microanalysis (EDS), and analytical chemical analysis (total oil and grease and petroleum hydrocarbons).

28493 (LA-SUB–94-103) **TA-59 North Parking Lot and Pajarito Road Corridor Analysis.** Los Alamos National Lab., NM (United States); Barton-Aschman Associates, Inc., San Jose, CA (United States). Dec 1993. 35p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. Order Number DE94016574. Source: OSTI; NTIS; GPO Dep.

The purpose of this report is to provide traffic engineering services for the TA-59 North Parking Lot/Pajarito Road corridor Analysis at Los Alamos National Laboratory. The following tasks were accomplished to assess the development of the north parking lot and Pajarito Road in the vicinity of TA-59: conducted turning-movement counts from 7 AM to 9 AM and from 4 PM to 6 PM at the Pajarito Road/TA-59 intersection; conducted a parking supply and demand survey for all the parking lots within TA-59 on half-hour intervals between 0600–1800 (6 AM to 6 PM); conducted mid-day directional speed study along Pajarito Road, just east or south of the TA-59/Pajarito Road intersection; conducted peak hour gap study on Pajarito Road in the vicinity of TA-59; reviewed the TA-59 Parking Lot North of Pajarito Road, FY-94 Weapons GPP Short List Candidate #9 report and other documents pertaining to past transportation studies; reassigned current turning-movement volumes with a 100 space parking lot being built on the north side of Pajarito Road; prepared traffic projections for the Pajarito Road/TA-59 intersection according to the proposed development on the north side of Pajarito Road that would employee 246 people; and assigned pedestrian crossing volumes between the northern lot/future development site and areas south of Pajarito Road.

28494 (LA-UR–94-2527) **Plant sentinels and molecular probes that monitor environmental munitions contaminants.** Jackson, P.J. (Los Alamos National Lab., NM (United States). Genomics and Structural Biology Group); DeWitt, J.G.; Hill, K.K.; Kuske, C.R.; Kim, D.Y. Los Alamos National Lab., NM (United States). [1994]. 10p. Sponsored by Department of Defense, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-9406213–3: 18. annual army environmental R&D symposium, Williamsburg, VA (United States), 28-30 Jun 1994). Order Number DE94016160. Source: OSTI; NTIS; GPO Dep.

Plants accumulate TNT and similar compounds from soil. Their sessile nature requires that plants adapt to environmental changes by biochemical and molecular means. In principle, it is possible to develop a monitoring capability based on expression of any gene that is activated by specific environmental conditions. The authors have identified plant genes activated upon exposure to TNT. Partial gene sequences allow design of DNA probes that measure TNT-induced gene activity. These will be used to develop sensitive assays that monitor gene expression in plants growing in environments possibly contaminated with explosives.

28495 (LBL–34581) **ITOUGH2 user's guide version 2.2.** Finsterle, S. Lawrence Berkeley Lab., CA (United States). Aug 1993. 109p. Sponsored by USDOE, Washington, DC (United States);Swiss National Cooperative for the Storage of Nuclear Waste, Baden (Switzerland). DOE Contract AC03-76SF00098. Order Number DE94011007. Source: OSTI; NTIS; GPO Dep.

ITOUGH2 is a program to estimate hydrogeologic model parameters for the numerical simulator TOUGH2. TOUGH2 was developed by Karsten Pruess at Lawrence Berkeley Laboratory for simulating non-isothermal flows of multicomponent, multiphase fluids in porous and fractured media. ITOUGH2 solves the inverse problem by automatic model calibration based on an indirect approach, in which some function of the difference between observed and model-predicted system response and appropriately weighted prior information about the parameters is minimized using standard optimization techniques. ITOUGH2 also provides a detailed error analysis of the estimated parameter set, and employs some procedures to study error propagation for prediction runs. This report includes a review of the inverse modeling theory, and a detailed description of the program architecture, input language, and the various user features provided by ITOUGH2. A sample problem is given to illustrate code application.

28496 (LUNBDS-NBGK–94-31) **Stable carbon and oxygen isotope studies of Late Weichselian lake sediments in southern Sweden and northern Poland, with palaeoclimatic implications.** Hammarlund, D. Centre d'Etudes et Recherches des Charbonnages de France (CERCHAR), 60 - Verneuil-en-Halatte (France). Apr 1994. 32p. Order Number DE94632206. Source: OSTI; NTIS; INIS.

Also published as LUNDQUA Thesis vol 31.

Late Weichselian lacustrine sediment sequences from southern Sweden and northern Poland were studied by stable isotope analysis to reconstruct the climatic development and climatically induced environmental changes in the respective regions. The methods used include analyses of the stable carbon isotope composition ($\delta^{13}C$) of bulk organic material, and the stable carbon and oxygen isotope compositions ($\delta^{13}C$, $\delta^{18}O$) of bulk carbonates and carbonate shells of aquatic organisms. These results were supported by lithological, chemical and biostratigraphic data (plant macrofossils, insects, molluscs). Chronological data were obtained by AMS radiocarbon dates and correlations based on pollen analysis. At c. 12.400 BP a climatic change from arctic, dry, and continental, to subarctic and more humid and maritime conditions occurred in southern Sweden. The Older Dryas stadial (c.12.200-12.000 BP) is characterized by a temporary return to generally colder , drier, and more continental conditions, followed by generally favourable (subarctic), although unstable, climatic conditions. At c. 11.300 BP a

gradual transition towards a colder and more continental climate was initiated, followed by total absence of limnic carbonates during the Younger Dryas stadial (c. 11.000-10.200 BP), indicating arctic and continental conditions. The transition to the Holocene is characterized by a rapid and strong climatic warming. The results from northern Poland point to some important differences compared to this development. A climatic warming around 13.000 BP was followed by generally favourable climatic conditions enabling continuous sedimentation of limnic carbonates during the Late Weichselian. Distinct depletions of ^{13}C in lacustrine organic material at the transition to the Holocene were recorded in southern Sweden, also demonstrated by decreasing mean values obtained from an extensive compilation of $\delta^{13}C$ data. (Abstract Truncated)

28497 (PNL–9873) **Summary and evaluation of hydraulic property data available for Eielson Air Force Base, Alaska.** Spane, F.A. Jr.; Thorne, P.D. Pacific Northwest Lab., Richland, WA (United States). Jul 1994. 74p. Sponsored by Department of Defense, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE94015942. Source: OSTI; NTIS; GPO Dep.

Most of the contaminant source areas at Eielson Air Force Base are located above an unconfined alluvial aquifer with relatively high hydraulic conductivity. Hydraulic tests that have been conducted on wells at the base were evaluated, and in some cases reanalyzed, to determine hydraulic conductivity and specific yield for the aquifer. The reviewed tests included 2 multiple-well pumping tests and 30 slug tests. One slug test was conducted on a well in the bedrock aquifer at Site 38. All the other tests were conducted on the alluvial aquifer.

28498 (PNL–9991) **Feasibility study for the United Heckathorn Superfund Site, Richmond, California.** Lincoff, A.H. (US Environmental Protection Agency, San Francisco, CA (United States). Region IX); Costan, G.P.; Montgomery, M.S.; White, P.J. Pacific Northwest Lab., Richland, WA (United States). Jul 1994. 143p. Sponsored by Environmental Protection Agency, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE94015297. Source: OSTI; NTIS; INIS; GPO Dep.

The United Heckathorn Superfund Site in Richmond, California, was used to formulate pesticides from approximately 1947 to 1966. Soils at the site and sediments in the harbor were contaminated with various chlorinated pesticides, primarily DDT, as a result of these activities. The US Environmental Protection Agency listed the site on the Superfund National Priorities List in 1990. This document is part of the Remedial Investigation and Feasibility Study phase of the Superfund response, which will provide the basis for selection of a final remedy that will protect human health and the environment and achieve compliance with federal and state enviroronental laws.

28499 (PNL-SA–23148) **Chemical speciation of radionuclides migrating in groundwaters.** Robertson, D. (Pacific Northwest Lab., Richland, WA (United States)); Schilk, A.; Abel, K.; Lepel, E.; Thomas, C.; Pratt, S.; Cooper, E.; Hartwig, P.; Killey, R. Pacific Northwest Lab., Richland, WA (United States). Apr 1994. 27p. Sponsored by Nuclear Regulatory Commission, Washington, DC (United States). DOE Contract AC06-76RL01830. (CONF-940401–16: International conference on methods and applications of radioanalytical chemistry, Kona, HI (United States), 10-16 Apr 1994). Order Number DE94015210. Source: OSTI; NTIS; INIS; GPO Dep.

In order to more accurately predict the rates and mechanisms of radionuclide migration from low-level waste disposal facilities via groundwater transport, ongoing studies are being conducted at field sites at Chalk River Laboratories to identify and characterize the chemical speciation of mobile, long-lived radionuclides migrating in groundwaters. Large-volume water sampling techniques are being utilized to separate and concentrate radionuclides into particular, cationic, anionic, and nonionic chemical forms. Most radionuclides are migrating as soluble, anionic species that appear to be predominantly organoradionuclide complexes. Laboratory studies utilizing anion exchange chromatography have separated several anionically complexed radionuclides, e.g., ^{60}Co and ^{106}Ru, into a number of specific compounds or groups of compounds. Further identification of the anionic organoradionuclide complexes is planned utilizing high resolution mass spectrometry. Large-volume ultra-filtration experiments are characterizing the particulate forms of radionuclides being transported in these groundwaters.

28500 (PNL-SA–24175) **Three neural network based sensor systems for environmental monitoring.** Keller, P.E.; Kouzes, R.T.; Kangas, L.J. Pacific Northwest Lab., Richland, WA (United States). May 1994. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830 ; FG06-89ER75522. (CONF-9405197–1: Electro @/94 international conference, Boston, MA (United States), 10-12 May 1994). Order Number DE94014557. Source: OSTI; NTIS; INIS; GPO Dep.

Compact, portable systems capable of quickly identifying contaminants in the field are of great importance when monitoring the environment. One of the missions of the Pacific Northwest Laboratory is to examine and develop new technologies for environmental restoration and waste management at the Hanford Site. In this paper, three prototype sensing systems are discussed. These prototypes are composed of sensing elements, data acquisition system, computer, and neural network implemented in software, and are capable of automatically identifying contaminants. The first system employs an array of tin-oxide gas sensors and is used to identify chemical vapors. The second system employs an array of optical sensors and is used to identify the composition of chemical dyes in liquids. The third system contains a portable gamma-ray spectrometer and is used to identify radioactive isotopes. In these systems, the neural network is used to identify the composition of the sensed contaminant. With a neural network, the intense computation takes place during the training process. Once the network is trained, operation consists of propagating the data through the network. Since the computation involved during operation consists of vector-matrix multiplication and application of look-up tables unknown samples can be rapidly identified in the field.

28501 (SCPRI-RM–2-1994) **Monthly results of measurements: February 1994.** Service Central de Protection contre les Rayonnements Ionisants, 78 - Le Vesinet (France). 1994. 43p. (In French). Order Number DE94632185. Source: OSTI; NTIS (US Sales Only); INIS.

This report of the SCPRI exposes the principal results concerning the routine monitoring of environmental radioactivity in France: atmospheric dusts, rainwater, surface water, underground water, sewage water, drinking water, food chain (milk, vegetables, fishes), sea water around nuclear sites and other sites. The activities of various radioisotopes are presented in tables. 20 refs., 10 tabs.

28502 (UCRL-ID–115393) **Preliminary report on the stable isotope imaging and characterization of surface and ground water resources in the southern Sacramento Valley.** Davisson, M.L. (Lawrence Livermore National Lab., CA (United States)); Criss, R.E.; Campbell, K.R. Lawrence Livermore National Lab., CA (United States). Nov 1993. 32p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. Order Number DE94012585. Source: OSTI; NTIS; GPO Dep.

This document contains information about the water resources in Sacramento. The project considers isotopic characterization of groundwater and the environmental effects of the misuse of water resources. In particular, the study looks at the effects extensive agriculture and the overdrafting of groundwater.

28503 (UCRL-ID–117543) **Natural and artificial nobel gas hydrologic tracers.** Hudson, G.B. Lawrence Livermore National Lab., CA (United States). Jun 1994. 30p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. Order Number DE94016010. Source: OSTI; NTIS; GPO Dep.

Noble gas isotopes provide opportunities for ground water tracing. Both naturally occurring tracers and artificially injected tracers can be used. The equilibration of water with the earth's atmosphere records the temperature and atmospheric pressure during ground water recharge. This temperature/pressure record can be used to distinguish cold recharge from warmer recharge with a resolution of 1-2 C temperature and 500m in altitude. The radioactive decay of U and Th produce large concentrations of 4He in old ground water and this 4He signature can be useful in tracing the small addition of old water (>10,000 yr.) to young water (<100 yr.). The decay of 3H present either form nuclear testing or cosmic ray interactions leads

to detectable amounts of 3He in young ground water (<50 yr.). By measuring both 3H and 3He, the mean age of the 3H in the water can be calculated. In addition to these natural tracers, isotopically enriched noble gas isotopes are readily available at low cost and can be used an non-hazardous water tracers. This inert, persistent, and harmless tracing technique can used in many situations at a cost of about one dollar per million gallons of water traced.

28504 (UCRL-JC–113790-Rev.2) **DOE capabilities for in-situ characterization and monitoring of formation properties in the vadose zone: Revision 2.** Hearst, J.R. (Lawrence Livermore National Lab., CA (United States)); Brodeur, J.R.; Koizumi, C.J.; Conaway, J.G.; Mikesell, J.L.; Nelson, P.H.; Stromswold, D.C.; Wilson, R.D. Lawrence Livermore National Lab., CA (United States). Sep 1993. 15p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-931095–39-Rev.2: Department of Energy environmental remediation conference, Augusta, GA (United States), 24-28 Oct 1993). Order Number DE94011757. Source: OSTI; NTIS; GPO Dep.

The DOE Environmental Restoration (ER) Program faces the difficult task of characterizing the properties of the subsurface and identifying and mapping a large number of contaminants at landfills, surface disposal areas, spill sites, nuclear waste tanks, and subsurface contaminant plumes throughout the complex of DOE facilities. Geophysical borehole logs can measure formation properties such as bulk density, water content, and lithology, and can quantitatively analyze for radionuclides and such elements as chlorine and heavy metals. Since these measurements can be repeated as desired, they can be used for both initial characterization and monitoring of changes in contaminant concentration and water content (sometimes linked to contaminant migration), at a fraction of the cost of conventional sampling. The techniques developed at several DOE laboratories, and the experience that we have gained in making in-situ measurements in the vadose zone, are applicable to problems at many other DOE sites. Moreover, they can capitalize on existing inventories of boreholes. By building on this experience workers involved in ER projects at those sites should be able to obtain high-quality data at substantial reductions in cost and time.

28505 (UCRL-JC–116572) **3D imaging of chemical transport in porous media.** Rashidi, M. (Lawrence Livermore National Lab., CA (United States). Measurement Science); Milanovich, F.P. Lawrence Livermore National Lab., CA (United States). Jun 1994. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-940853–4: Summer meeting of the American Institute of Chemical Engineers, Denver, CO (United States), 14-17 Aug 1994). Order Number DE94016455. Source: OSTI; NTIS; GPO Dep.

In recent years, investigation of chemical transport in porous media has drawn considerable attention in many fields due to its potential applications in environmental problems, chemical and petroleum related processes, and microbiological systems. Chemical transport porous media has been studied using a novel non-intrusive fluorescence imaging technique. The test section consists of a porous column packed with spherical beads and a refractive index-matched fluid seeded with tracer particles or a dye for velocity and concentration measurements, respectively. The system is automated to image through the porous medium for collecting local values of velocity and concentration at a good accuracy and a high resolution. A complete flow experiment was carried out in which a dye front was injected into the porous system and its dispersion was tracked. Microscopic velocity and concentration fields were obtained in a full three-dimensional volume of the test section.

28506 (WHC-SA–2284) **Field screening for aldrin in soil by immunoassay.** McCain, R.G.; Myers, M.L. Westinghouse Hanford Co., Richland, WA (United States). [1994]. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-940178–2: 2. international conference on on-site analysis and field-portable instrumentation, Houston, TX (United States), 24-26 Jan 1994). Order Number DE94015640. Source: OSTI; NTIS; INIS; GPO Dep.

A number of 5-gal cans labeled "aldrin" were found dumped in an isolated area near the boundary of the Hanford Site. Initial laboratory analysis showed high concentrations of aldrin in the soil directly beneath the cans. The site was included in an expedited response action (ERA) undertaken to clean up a large area along the western margin of the Hanford Site. A commercially available immunoassay test kit was modified to screen for aldrin in soil at an action level of 2 mg/kg. Field tests carried out as the contaminated soil was removed showed that the contamination extended significantly deeper than originally anticipated. The field immunoassay provided the cleanup crew with rapid turnaround results, which were used to guide the cleanup activity.

28507 (WHC-SA–2358) **Some statistical aspects of background based groundwater standards at an arid hazardous waste site.** Chou, C.J.; Hodges, F.N.; Johnson, V.G. Westinghouse Hanford Co., Richland, WA (United States). Jul 1994. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-940748–9: Institute of Nuclear Materials Management annual meeting, Naples, FL (United States), 17-20 Jul 1994). Order Number DE94015669. Source: OSTI; NTIS; INIS; GPO Dep.

Statistical goodness-of-fit tests and "Box and Whisker" plots of hydrochemical data from selected contaminant-free downgradient wells, and wells located upgradient in a non-contaminated or background area show that spatially distinct sample populations do not exhibit significant differences in groundwater chemical composition within the upper unconfined aquifer. Well location dominates natural constituent variability at this arid site. Spatial coverage should be emphasized in such cases rather than sampling frequency. 5 refs., 3 figs., 1 tab.

28508 (WHC-SD-EN-TI–228) **Geophysical survey for proposed borehole 199-K-108A, 100-K Area.** Bergstrom, K.A.; Mitchell, T.H. Westinghouse Hanford Co., Richland, WA (United States). 15 Feb 1994. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE94015757. Source: OSTI; NTIS; GPO Dep.

The objective of the electromagnetic survey was to locate subsurface obstructions that may affect the drilling of proposed borehole, 199-K-108A, about 75 ft southeast of the 105 KW Building, 100-K Area. Based upon the results of the survey, possible drill sites within the zone, with the least likelihood of encountering identified obstructions, were identified.

28509 (WHC-SD-EN-TI–265) **Carbon tetrachloride ERA soil-gas baseline monitoring.** Fancher, J.D. Westinghouse Hanford Co., Richland, WA (United States). [1994]. 55p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE94015335. Source: OSTI; NTIS; INIS; GPO Dep.

From December 1991 through December 1993, Westinghouse Hanford Company performed routine baseline monitoring of selected wells ad soil-gas points twice weekly in the 200 West Area of the Hanford Site. This work supported the carbon Tetrachloride Expedited Response Action (ERA) and provided a solid baseline of volatile organic compound (VOC) concentrations in wells and in the subsurface at the ERA site. As site remediation continues, comparisons to this baseline can be one means of measuring the success of carbon tetrachloride vapor extraction. This report contains observations of the patterns and trends associated with data obtained during soil-gas monitoring at the 200 West Area: Monitoring performed since late 1991 includes monitoring soil-gas probes ad wellheads for volatile organic compounds (VOCs). This report reflects monitoring data collected from December 1991 through December 1993.

28510 (WSRC-MS–94-0113) **Analysis of censored data in groundwater monitoring wells at the Savannah River Site.** Weber, J.H. Westinghouse Savannah River Co., Aiken, SC (United States). [1994]. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035. (CONF-940748–15: Institute of Nuclear Materials Management annual meeting, Naples, FL (United States), 17-20 Jul 1994). Order Number DE94015568. Source: OSTI; NTIS; INIS; GPO Dep.

It is common in environmental analyses to deal with censored data. Censored data characteristically arise through laboratory analysis of samples with contaminant concentrations less than what the analytical method is able to reliably detect. These data

are called "less than detectable." Comparisons between downgradient or monitoring groundwater wells and upgradient or background wells are frequently done to determine if downgradient wells are more contaminated than background or some established maximum concentration limits (MCL's). In addition, parameter estimates are often desired. The presence of censored data complicates the statistics that can be used as estimators for individual populations or to estimate differences between two populations. This paper describes the current process at Savannah River Site (SRS) to determine constituents of concern (COC's) for complying with groundwater monitoring and clean-up regulations. COC's are analytes found in downgradient monitoring wells in concentrations significantly greater than in background wells or significantly greater than the MCL'S. Both parametric and non-parametric statistics are explored. Data plots are examined for outliers, trends, laboratory or sampling contamination, and unusually large detection limits for censored results. Wells are grouped by similar concentration levels to form a "characteristic" well, improving the estimation and decision process.

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Refer also to citation(s) 27214, 27215, 27216, 27309, 27310, 27311, 27312, 27313, 27314, 27315, 27316, 27317, 27318, 27319, 27321, 27322, 27440, 27441, 27442, 27460, 27467, 27476, 27589, 27590, 27678, 27679, 27680, 27805, 27983, 28087, 28474, 28497, 28500, 28554, 28926, 28928

28511 (BNL–49469) **Measurements for satellite validation made from R/V "Alliance" during October and November 1991.** Minnett, P.J. Brookhaven National Lab., Upton, NY (United States). Aug 1993. 279p. Sponsored by USDOE, Washington, DC (United States);National Oceanic and Atmospheric Administration, Washington, DC (United States). DOE Contract AC02-76CH00016. Order Number DE94009106. Source: OSTI; NTIS; GPO Dep.

Measurements of sea-surface temperature, surface meteorology and atmospheric profiles taken from the R/V Alliance between 1 October and 9 November 1991. During this time the ship sailed from Amsterdam to La Spezia and then was deployed in the western Mediterranean Sea. The measurements are presented in graphical form, and daily statistics are given as tables. True winds, net long-wave radiation and turbulent air-sea fluxes have been calculated and are also presented. The measurements were made for application to studies of the accuracies of the retrieval of sea-surface temperature and atmospheric precipitable water from satellite radiometers.

28512 (DOE/BP/01610–2) **Annual Coded Wire Tag Program Oregon Missing Production Groups: Annual report 1993.** Garrison, R.L.; Issac, D.L.; Lewis, M.A.; Murray, W.M. Oregon Dept. of Fish and Wildlife, Portland, OR (United States). Apr 1994. 79p. Sponsored by USDOE, Washington, DC (United States). DOE Contract BI79-89BP01610. Order Number DE94016039. Source: OSTI; NTIS; GPO Dep.

This document contains information about the Columbia Basin Fish and Wildlife Program funded by Bonneville Power Administration. Topics discussed include: background information, a system of monitoring and evaluation of fish production, coded-wire tagging program, and the results of each of the fisheries. Most information is portrayed in the form of charts and tables.

28513 (DOE/ER/61464–2) **Multiple measurement of the coupling between benthic carbon fluxes and bioturbation activity during the Spring bloom: Progress report, 1993.** Aller, R.C.; Aller, J.J.; Cochran, J.K.; Lee, C. State Univ. of New York, Stony Brook, NY (United States). Marine Sciences Research Center. [1993]. 13p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-92ER61464. Order Number DE94013771. Source: OSTI; NTIS; GPO Dep.

The primary purposes of the PULSE project were the examination of benthic biogeochemical response to pulsed inputs (nonsteady state) of organic matter and biogenic debris in shelf-depth environments, and evaluation of coherence between different possible tracers of benthic biogeochemical processes during such inputs. In order to accomplish these, we established a single experimental site (14m depth) in central Long Island Sound and followed the input and fate of biogenic debris from the annual Spring phytoplankton bloom within the bottom sediment. The timing of the bloom was documented by sampling surface water properties every few days from the Port Jefferson Bridgeport Ferry. In addition, a total of 12 bottom sampling cruises were made, 11 from Dec. 1992 to June 93 and once during Nov 93. Although the study emphasis was on relatively rapid processes in surface sediments, during Nov 93, a ~ 3m long Kasten core was also obtained to provide information on the translation of interface processes into the sedimentary record.

28514 (DOE/ER/61716–1) **Southern ocean controls on current ice shelf evolution: Annual progress report, September 1, 1993–August 31, 1994.** Hellmer, H.H.; Jacobs, S.S. Columbia Univ., Palisades, NY (United States). Lamont-Doherty Earth Observatory. Apr 1994. 39p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-93ER61716. Order Number DE94016534. Source: OSTI; NTIS; GPO Dep.

A seasonal cycle of shelf water temperatures and salinities observed at the eastern Ross Ice Shelf edge was used to force a two-dimensional thermohaline circulation model adapted to two different sub-ice cavity paths around Roosevelt Island. Model results verified by current meter measurements reveal that shelf water flowing into the cavity west of Roosevelt Island might follow a sub-ice path with nearly constant water column thickness of 200 m. This would largely exclude the grounding line of the northern Siple Coast from the contact with open ocean water masses. In contrast to the forcing with time-independent summer profiles, seasonal forcing causes a higher spatial and temporal variability of the cavity's circulation and property distribution. At the model's open boundaries the intermitted inflow of shelf water displaces the meltwater outflow originating from the interior ice shelf base to greater depth and initiates an additional shallow meltwater plume. The average melting along the ice shelf base increases from 0.07 m/a to 0.38.m/a due to seasonality in shelf water characteristics, and to 2.3 m/a, if we introduce a 100-year temperature rise of 1°C. The rate decreases, if salinity simultanously decreases; a possible scenario, if the enhanced meltwater outflow mixes with shelf water in front of the ice shelves.

28515 (DOE/EW/53023–T7) **Hazardous materials in aquatic environments of the Mississippi River Basin: Quarterly project status report, 1 April–30 June 1994.** Tulane Univ., New Orleans, LA (United States). [1994]. 46p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG01-93EW53023. Order Number DE94016037. Source: OSTI; NTIS; GPO Dep.

This report contains a cluster of twenty separate project reports concerning the fate, environmental transport, and toxicity of hazardous wastes in the Mississippi River Basin. Some of topics investigated involve: biological uptake and metabolism; heavy metal immobilization; biological indicators; toxicity; and mathematical models.

28516 (EGG-CIET–11127) **FY 1993 environmental sampling and analysis report for wastewater discharge at McMurdo Station, Antarctica.** Crockett, A.B. EG and G Idaho, Inc., Idaho Falls, ID (United States). Apr 1994. 74p. Sponsored by USDOE, Washington, DC (United States);National Science Foundation, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE94015256. Source: OSTI; NTIS; GPO Dep.

Wastewater impact assessment at McMurdo has been or is being conducted by four organizations: Antarctic Support Associates (ASA), which conducts the effluent monitoring; Moss Landing Marine Laboratories, which conducts all of the benthic monitoring and most of the biological monitoring; Montana State University, which conducted water quality and water current measurements; and EG&G Idaho, which conducted water quality and sea ice monitoring. All four programs are interrelated and were needed to determine the impact of the wastewater discharge on the marine environment. This report summarizes the relevant monitoring work being conducted by Antarctic Support Associates, Moss Landing, and Montana State personnel, and specifically documents the results of EG&G Idaho's efforts.

28517 (FRCEA-TH–392) **Use of scattered media to determine lanthanides and actinides in natural water: application to uranium.** Reiller, P. CEA Centre d'Etudes de Saclay, 91 - Gif-sur-Yvette (France). Dept. des Procedes d'Enrichissement; Paris-6 Univ., 75 (France). Nov 1993. 166p. (In French). Order Number DE94632214. Source: OSTI; NTIS (US Sales Only); INIS.

This thesis has three parts; in the first one we present the general knowledge necessary to the understanding of phenomena to which we are going to be confronted: analysis by laser spectrofluorimetry with temporal resolution, chemistry in aqueous solution of uranium, fluorescence properties of uranium, chemistry of surfactants and their appliance in fluorescence exaltation; principle of ultrafiltration and application to ultrafiltration assisted by micella. In the second part, we will study the spectral and temporal properties of fluorescence with surfactants in the framework of using laser spectrofluorimetry with temporal resolution. In the last part, we will interest in the coupling of spectrofluorimetry and ultrafiltration assisted by micella.

28518 (INIS-JP–019, pp. 305-316) **Particulate flux of natural radioactive isotopes in the pacific ocean.** Harada, Koh (Hokkaido Univ., Hakodate (Japan). Faculty of Fisheries); Narita, H.; Tate, K.; Noriki, S.; Tsunogai, S. Waseda Univ., Tokyo (Japan). 1993. 793p. (CONF-9203300–: International symposium on global change (IGBP), Tokyo (Japan), 27-29 Mar 1992). In *Proceedings: international symposium on global change (IGBP)*. Order Number DE94765351. Source: OSTI; NTIS; INIS.

Sediment trap experiments were carried out at two stations in the northern North Pacific, three stations in the western North Pacific and one station located at the west side of the slope of the northern Japan Trench. Some natural radioactive isotopes, such as ^{230}Th, ^{210}Pb and ^{210}Po in the settling particle samples were measured. The particulate flux of ^{210}Pb in the western North Pacific was about two times larger than the flux in the northern North Pacific, whereas the total mass fluxes were not significantly different. At the west side of the slope of the northern Japan Trench, the total flux was 2.5 time larger than the flux in the bottom-most sediment trap at one station in the western North Pacific located to 230 km southeast of the Japan Trench station. The ^{210}Pb and ^{230}Th fluxes at the Japan Trench station were also larger than the fluxes at the WNP station. The ^{210}Pb/Al ratio in the settling particle increased with increasing Al content and also increasing the distance from the continental margin. This indicates that the isotopes are incorporated into the fine terrestrial particles during the lateral transport of the particles. (author).

28519 (NGU–93-121) **Radioelement (U,Th,Rn) concentrations in Norwegian bedrock groundwaters.** Banks, D.; Roeyset, O.; Strand, T.; Skarphagen, H. Norges Geologiske Undersoekelse, Trondheim (Norway). Dec 1993. 44p. Order Number DE94632215. Source: OSTI; NTIS; INIS.

Samples of groundwater from bedrock boreholes in three Norwegian geological provinces have been analysed for content of ^{222}Rn, U and Th. Median values of 290 Bq/l, 7.6 μg/l and 0.02 μg/l were obtained for Rn, U and Th, respectively, while maximum values were 8500 Bq/l, 170 μg/l and 2.2 μg/l. Commonly suggested drinking water limits range from 8 to 1000 Bq/l for radon and 14 to 160 μg/l for uranium. Radioelement content was closely related to lithology, the lowest concentrations being derived from the largely Caledonian rocks of the Troendelag area, and the highest from the Precambrian Iddefjord Granite of South East Norway where median values of 2500 Bq/l, 15 μg/l and 0.38 μg/l, respectively, were obtained. The Iddefjord Granite is not believed to be unique in Norway yielding high dissolved radionuclide contents in groundwaters, and several other granitic aquifers warrant further investigation in this respect. 63 refs., 13 figs., 8 tabs.

28520 (ORNL/ER–202) **Surface water sampling and analysis plan for environmental monitoring in Waste Area Grouping 6 at Oak Ridge National Laboratory, Oak Ridge, Tennessee: Environmental Restoration Program.** Oak Ridge National Lab., TN (United States); CDM Federal Programs Corp., Oak Ridge, TN (United States). Jun 1994. 136p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE94015939. Source: OSTI; NTIS; INIS; GPO Dep.

This Sampling and Analysis Plan addresses surface water monitoring, sampling, and analysis activities that will be conducted in support of the Environmental Monitoring Plan for Waste Area Grouping (WAG) 6. WAG 6 is a shallow-burial land disposal facility for low-level radioactive waste at the Oak Ridge National Laboratory, a research facility owned by the US Department of Energy and managed by Martin Marietta Energy Systems, Inc. Surface water monitoring will be conducted at nine sites within WAG 6. Activities to be conducted will include the installation, inspection, and maintenance of automatic flow-monitoring and sampling equipment and manual collection of various water and sediment samples. The samples will be analyzed for various organic, inorganic, and radiological parameters. The information derived from the surface water monitoring, sampling, and analysis will aid in evaluating risk associated with contaminants migrating off-WAG, and will be used in calculations to establish relationships between contaminant concentration (C) and flow (Q). The C-Q relationship will be used in calculating the cumulative risk associated with the off-WAG migration of contaminants.

28521 (PNL–9960) **Trends in radionuclide concentrations in Hanford Reach fish, 1982 through 1992.** Poston, T.M. Pacific Northwest Lab., Richland, WA (United States). Jun 1994. 92p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE94015394. Source: OSTI; NTIS; INIS; GPO Dep.

Environmental monitoring has been conducted at the US Department of Energy's Hanford Site in southeast Washington State since 1945. Fish from the Hanford Reach of the Columbia River, which borders the Site, are monitored annually. The two objectives of this report were (1) to evaluate trends in the concentrations of radionuclides [e.g., ^{90}Sr and ^{137}Cs] in two species of Columbia River fish [smallmouth bass and mountain whitefish] sampled from the Hanford Reach from 1982 through 1992; and (2) to determine the impact of Hanford Site releases on these two species and carp and fall chinook salmon collected during this time frame. The evaluation found gradual reductions of ^{137}Cs in bass muscle and ^{90}Sr in bass and whitefish carcass from 1982 through 1992. Concentrations of ^{90}Sr in bass and whitefish followed the pattern established by reported Hanford Site releases from 1982 through 1992 and was supported by significant regression analyses comparing annual releases to sample concentration. Because data for carp have been collected only since 1990, the data base was inadequate for determining trends. Moreover, fall chinook salmon were only sampled once in this 11-year period. Concentrations of ^{90}Sr and ^{137}Cs in fish samples collected from distant background locations exceeded concentrations in Hanford Reach fish. Estimates of the dose from consumption of Hanford Reach fish were less than 0.001 times the National Council on Radiation Protection and Measurements and the US Department of Energy guideline of 100 mrem/yr.

28522 (STUK-A–94) **Radioactivity of surface water and freshwater fish in Finland in 1988-1990: Supplement 6 to Annual Report STUK-A–89.** Saxen, R.; Koskelainen, U. Finnish Centre for Radiation and Nuclear Safety (STUK), Helsinki (Finland). Feb 1992. 79p. Order Number DE94632216. Source: OSTI; NTIS; INIS.

Changes over time in the activity concentrations of radionuclides in surface water and in the five largest rivers and some smaller rivers discharging into the Baltic Sea were monitored in 1988-1990. The dominant gamma-emitting radionuclides were ^{137}Cs and ^{134}Cs. The effect of the uneven distribution of Chernobyl deposition is still seen in the results. The activity concentrations of ^{137}Cs in surface water have decreased significantly: In the drainage area where the activity concentrations were highest after the Chernobyl accident, the concentrations in October 1990 were only about 1-4% of the maximum values in May 1986. The decrease in the activity concentrations of ^{90}Sr was much slighter. The study of areal and temporal changes in the activity concentrations of ^{137}Cs in fish, started in 1986, continued in 1988-1990. In all, about 2400 fish samples from southern and middle Finland (excluding Lappland) were analyzed gammaspectrometrially during these three years. Seventeen different fish species were included in the study. (20 refs., 14 figs., 30 tabs.).

28523 (UCRL-ID–117550) **LLNL demonstration of base hydrolysate decomposition in a 0.035 gallon per minute scale reactor.** Cena, R.J.; Thorsness, C.B.; Coburn, T.; Watkins, B.E. Lawrence Livermore National Lab., CA (United States). 1 Jun 1994. 23p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. Order Number DE94016013. Source: OSTI; NTIS; GPO Dep.

The Lawrence Livermore National Laboratory (LLNL) has built and operated a pilot plant for processing oil shale using recirculating hot solids. This pilot plant, was adapted in 1993 to demonstrate the feasibility of decomposing base hydrolysate, a mixture of sodium nitrite, sodium formate and other constituents. This material is the waste stream from the base hydrolysis process for destruction of energetic materials, being studied by researchers at Los Alamos National Laboratory (LANL). In the Livermore process, the waste feed is thermally treated in a moving packed bed of ceramic spheres, where constituents in the waste decompose, in the presence of carbon dioxide, to form solid sodium carbonate and a suite of gases including: methane, carbon monoxide, oxygen, nitrogen oxides, ammonia and possibly molecular nitrogen. The authors performed an extended one day (8 hour) test of the solids recirculation system, with continuous injection of approximately 0.035 gal/min of waste for period of seven hours. Continuous on-line gas analysis was invaluable in tracking the progress of the experiment and quantifying the decomposition products. Analyses showed the primary solid product, collected in the lift exit cyclone, was indeed sodium carbonate, as expected. For the reactor condition studied in this test, N_2O was found to be the primary nitrogen bearing gas species. However, other experimental results indicate that in a more oxidizing environment, with longer residence times, the production of N_2O can be limited. In the test, approximately equal quantities of ammonia and nitrogen bearing oxide gases were produced (NO, NO_2 and N_2O).

28524 (WSRC-TR–94-0212) **Radioecological implications of the Par Pond drawdown.** Hickey, H. (Westinghouse Savannah River Co., Aiken, SC (United States)); Whicker, F.W. Westinghouse Savannah River Co., Aiken, SC (United States). 5 Dec 1991. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035. Order Number DE94015550. Source: OSTI; NTIS; INIS; GPO Dep.

The drawdown of the Par Pond reservoir created dramatic alterations in this formerly stable lentic ecosystem. In addition, the radiation environment at Par Pond has changed significantly because of the exposure of Cesium 137-contaminated sediments and the appearance of new transport pathways to the terrestrial environment. In response to this situation, SREL was asked to study the radioecological implications of the reservoir drawdown. This report contains the objectives, methods, and results of the SREL study.

55 BIOMEDICAL SCIENCES, BASIC STUDIES

5502 Biochemistry

Refer also to citation(s) 28545, 28546, 28768

28525 (ANL/BIM/PP–73220) **The functions of tryptophan residues in membrane proteins.** Schiffer, M.; Chang, C.H.; Stevens, F.J. Argonne National Lab., IL (United States). [1994]. 18p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. Order Number DE94016384. Source: OSTI; NTIS; GPO Dep.

Membrane proteins in general have a significantly higher Trp content than do soluble proteins. This is especially true for the M and L subunits of the photosynthetic reaction center from purple bacteria. The Trp residues are located mostly in the segments that connect the transmembrane helices. Further, they are concentrated at the periplasmic side of the complex. Within the protein subunits, many form hydrogen bonds with carbonyl oxygens of the main chain, thereby stabilizing the protein. On the surface of the molecule, they are correctly positioned to form hydrogen bonds with the lipid head groups while their hydrophobic rings are immersed in the lipid part of the bilayer. We suggest that Trp residues are involved in the translocation of protein through the membrane and that following translocation, Trp residues serve as anchors on the periplasmic side of the membrane.

28526 (DOE/ER/20041–2) **Structure and regulation of an archaebacterial promoter: An in vivo study: Progress report.** Daniels, C.J. Ohio State Univ., Columbus, OH (United States). Dept. of Microbiology. [1993]. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-91ER20041. Order Number DE94015712. Source: OSTI; NTIS; GPO Dep.

In the initial grant period the authors have devised an in vivo assay system for the analysis of gene expression in the halophilic archaea. This system has been used to analyzed the H. volcanii tRNALys promoter where it was found that the a 40 bp fragment carrying BoxA and BoxB sequences in sufficient for in vivo expression. Detailed analysis of the BoxA element indicates that the BoxA TA sequence is essential for efficient expression. Support for the hypothesis that all archaea share common transcriptional signals was obtained when a methanogen tRNAGln gene, with its associated BoxA sequence, was found to direct its own transcription in H. volcanii. In related experiments a eukaryotic RNA polymerase 3 terminator was found to act as a strong termination signal in H. volcanii. Sequence comparisons between this element and mapped RNA 3′ ends indicates that T-rich sequences may be important role in directing termination in vivo. Finally, in an attempt to establish a model system to study regulated gene expression, the authors have isolated a DNA fragment that encodes a heat shock inaudible transcript. This gene will not serve as a model for detailed studies of the mechanisms of gene expression in the archaea.

28527 (KCP–613-5288) **Molecular model generator toolkit.** Schneider, R.D. Allied-Signal Aerospace Co., Kansas City, MO (United States). Kansas City Div. Jul 1994. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00613. Order Number DE94015177. Source: OSTI; NTIS; GPO Dep.

This report is a user manual for an ASCII file of Fortran source code which must be compiled before use. The software will assist in creating plastic models of molecules whose specifications are described in the Brookhaven Protein Databank. Other data files can be used if they are in the same format as the files in the databank. The output file is a program for a 3-D Systems Stereolithography Apparatus and the program is run on a SGI Indigo workstation.

28528 (PNL-SA–24337) **Rational enzyme redesign.** Ornstein, R.L. Pacific Northwest Lab., Richland, WA (United States). May 1994. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. (CONF-9405190–1: LIGNIN workshop on research needs in LIGNIN biosynthesis and biodegradation, Pacific Grove, CA (United States), 25-26 May 1994). Order Number DE94014565. Source: OSTI; NTIS; GPO Dep.

Protein engineering is first a means of elucidating structure-function relations in an enzyme, and second, a means of changing a protein to make it serve a different, but generally related, purpose. In principle, one may change the functional characteristics of an enzyme by altering its substrate specificity, kinetics, optimum range of activity, and chemical mechanism. Obviously one cannot make all possible combinations of amino acid changes for even the smallest enzyme, so the essential question is which changes to make. The intent of rational protein/enzyme redesign is to alter a protein/enzyme in a timely and premeditated fashion. This article provides an outline of the process of rational enzyme redesign.

5503 Cytology

Refer also to citation(s) 28567

5504 Genetics

Refer also to citation(s) 28525, 28527, 28957

28529 (DOE/ER/61502–1) **International workshop on Chromosome 12 held at St. Catherine's College, Oxford, England,**

September 18–20, 1992: Final report. Gemmill, R. Eleanor Roosevelt Inst., Denver, CO (United States). [1992]. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-92ER61502. (CONF-9209320–1: International workshop on chromosome 12, Oxford (United Kingdom), 18-20 Sep 1992). Order Number DE94014676. Source: OSTI; NTIS; GPO Dep.

The First International Mapping Workshop on Human Chromosome 12 was held on Sept. 18–20, 1992, at St Catherine's College, Oxford, UK. The meeting was hosted by Ian Craig and organized by Drs. Craig, Gemmill and Kutcherlapati. It was attended by 50 participants primarily from Europe and the USA. The workshop was highly successful and achieved the major goal of fostering direct and personal interactions between investigators with strong research interests in this chromosome. Participants reviewed the status of several critical aspects of chromosome mapping and prepared consensus views of the current state of knowledge. In addition, lists of resources available for this chromosome including somatic cell hybrids, individual DNA clones and libraries and genetic markers were prepared.

5506 Medicine

Refer also to citation(s) 27566, 28000, 28546, 28550

28530 (CEA-CONF–11694) **An efficient, interactive, and parallel system for biomedical volume analysis on a standard workstation.** Rebuffel, V.; Gonon, G. CEA Centre d'Etudes de Grenoble, 38 (France). Direction des Technologies Avancees. 5 Feb 1992. 7p. (CONF-9210470–: VBC'92: Visualization in biomedical computing, Chapel Hill (United States), 13-16 Oct 1992). Order Number DE94632417. Source: OSTI; NTIS (US Sales Only); INIS.

A software package is presented that can be employed for any 3D imaging modalities: X-ray tomography, emission tomography, magnetic resonance imaging. This system uses a hierarchical data structure, named Octree, that naturally allows a multi-resolution approach. The well-known problems of such an indeterministic representation, especially the neighbor finding, has been solved. Several algorithms of volume processing have been developed, using these techniques and an optimal data storage for the Octree. A parallel implementation was chosen that is compatible with the constraints of the Octree base and the various algorithms. (authors) 4 refs., 3 figs., 1 tab.

28531 (CONF-940301–36) **Development of radiohalogenated muscarinic ligands for the in vivo imaging of m-AChR by nuclear medicine techniques.** McPherson, D.W.; Luo, H.; Knapp, F.F. Jr. Oak Ridge National Lab., TN (United States). [1994]. 28p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From 207. spring national meeting of the American Chemical Society (ACS); San Diego, CA (United States); 13-18 Mar 1994. Order Number DE94013261. Source: OSTI; NTIS; GPO Dep.

Alterations in the density of acetylcholinergic muscarinic receptors (m-AChR) have been observed in various dementias. This has spurred interest in the development of radiohalogenated ligands which can be used for the non-invasive in vivo detection of m-AChR by nuclear medicine techniques. We have developed a new ligand 1-azabicyclo[2.2.2]oct-3-yl (α-hydroxy-α-(1-iodo-1-propen-3-yl)-α-phenylacetate (IQNP,12) which demonstrates high affinity for the muscarinic receptor. When labeled with radioiodine it has been shown to be selective and specific for m-ACHR. Initial studies on the separation and in vivo evaluation of the various isomers of IQNP have shown that the stereochemistry of the chiral centers and the configuration around the double bond play an important role in m-AChR subtype specificity. In vivo evaluation of these stereoisomers demonstrate that E-(R,R)-IQNP has a high affinity for the M_1 muscarinic subtype while Z-(R,R)-IQNP demonstrate a high affinity for M_1 and M_2 receptor subtypes. These data demonstrate IQNP (12) has potential for use in the non-evasive in vivo detection of m-AChR by single photon emission computed tomography (SPECT). A brominated analogue, "BrQNP," in which the iodine has been replaced by a bromine atom, has also been prepared and was shown to block the in vivo uptake of IQNP in the brain and heart and therefore has potential for positron emission tomographic (PET) studies of m-AChR.

28532 (LA-UR–94-1446) **Effect of conductor geometry on source localization: Implications for epilepsy studies.** Schlitt, H.; Heller, L.; Best, E.; Ranken, D.; Aaron, R. Los Alamos National Lab., NM (United States). [1994]. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-9404183–1: NABMAG 2: North American Biomagnetism Action Group conference, Detroit, MI (United States), 15-17 Apr 1994). Order Number DE94014718. Source: OSTI; NTIS; INIS; GPO Dep.

We shall discuss the effects of conductor geometry on source localization for applications in epilepsy studies. The most popular conductor model for clinical MEG studies is a homogeneous sphere. However, several studies have indicated that a sphere is a poor model for the head when the sources are deep, as is the case for epileptic foci in the mesial temporal lobe. We believe that replacing the spherical model with a more realistic one in the inverse fitting procedure will improve the accuracy of localizing epileptic sources. In order to include a realistic head model in the inverse problem, we must first solve the forward problem for the realistic conductor geometry. We create a conductor geometry model from MR images, and then solve the forward problem via a boundary integral equation for the electric potential due to a specified primary source. One the electric potential is known, the magnetic field can be calculated directly. The most time-intensive part of the problem is generating the conductor model; fortunately, this needs to be done only once for each patient. It takes little time to change the primary current and calculate a new magnetic field for use in the inverse fitting procedure. We present the results of a series of computer simulations in which we investigate the localization accuracy due to replacing the spherical model with the realistic head model in the inverse fitting procedure. The data to be fit consist of a computer generated magnetic field due to a known current dipole in a realistic head model, with added noise. We compare the localization errors when this field is fit using a spherical model to the fit using a realistic head model. Using a spherical model is comparable to what is usually done when localizing epileptic sources in humans, where the conductor model used in the inverse fitting procedure does not correspond to the actual head.

28533 Preventive maintenance system for the photomultiplier detector blocks of pet scanners. Levy, A.V.; Warner, D. To Dept. of Energy. 1992. Filed date 24 Aug 1992. U.S. Patent Application 7-934,714. 50p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH00016. Order Number DE94016107. Source: OSTI; NTIS; GPO Dep.

The present invention relates to a system for the preventive maintenance of the Photomultiplier Detector Blocks of PET Scanners. This system is used to automatically indicate the expected date of failure of a photomultiplier detector block and provide time for its replacement and maintenance in a scheduled preventive maintenance program, thus eliminating expensive unscheduled downtime of a PET Scanner due to photomultiplier failure.

28534 (UCRL-JC–116175-Rev.1) **Processing of prosthetic heart valve sounds for classification: Revision 1.** Candy, J.V.; Jones, H.E. Lawrence Livermore National Lab., CA (United States). Apr 1994. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-9406221–1-Rev.1: 7. annual Institute for Electrical and Electronic Engineers (IEEE) symposium on computer based medical systems, Winston Salem, NC (United States), 10-11 Jun 1994). Order Number DE94015143. Source: OSTI; NTIS; GPO Dep.

People with serious heart conditions have had their expected life span extended considerably with the development of the prosthetic heart valve especially with the great strides made in valve design. Even though the designs are extremely reliable, the valves are mechanical and operating continuously over a long period, therefore, structural failures can occur due to fatigue. Measuring heart sounds non-invasively in a noisy environment puts more demands on the signal processing to extract the desired signals from the noise. In this paper the authors discuss acoustical signal processing techniques developed to process noisy heart valve sounds measured by a sensitive, surface contact microphone and used for the eventual classification of the valve.

28535 (UCRL-JC-117704) **Classification of heart valve single leg separations from acoustic clinical measurements.** Clark, G.A.; Bowman, B.C.; Boruta, N.; Thomas, G.H.; Jones, H.E.; Buhl, M.R. Lawrence Livermore National Lab., CA (United States). May 1994. 27p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-9410156-1: 28. annual Asilomar conference on signals, systems, and computers, Pacific Grove, CA (United States), 31 Oct - 2 nov 1994). Order Number DE94015179. Source: OSTI; NTIS; GPO Dep.

Our system classifies the condition (intact or single leg separated) of in vivo Bjork-Shiley Convexo-Concave (BSCC) heart valves by processing acoustic measurements of clinical heart valve opening sounds. We use spectral features as inputs to a two-stage classifier, which first classifies individual heart beats, then classifies valves. Performance is measured by probability of detection and probability of false alarm, and by confidence intervals on the probability of correct classification. The novelty of the work lies in the application of advanced techniques to real heart valve data, and extensions of published algorithms that enhance their applicability. We show that even when given a very small number of training samples, the classifier can achieve a probability of correct classification of 100%.

5507 Microbiology

Refer also to citation(s) 27323, 27496

28536 (CONF-9205407--Absts.) **International Symposium on Topics in Microbial Diversity, Metabolism, and Physiology: Final report, May 22--23, 1992.** Konisky, J. Illinois Univ., Urbana, IL (United States). Jul 1993. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-92ER20062. From International symposium on topics in microbial diversity, metabolism, and physiology; Urbana, IL (United States); 22-23 May 1992. Order Number DE94013178. Source: OSTI; NTIS; GPO Dep.

A brief overview with abstracts of invited presentations is provided for the International Symposium on Topics in Microbial Diversity, Metabolism, and Physiology.

5510 Physiological Systems

Refer also to citation(s) 28534

5520 Public Health

28537 (DOE/ER/61395-T2) **Studies in genetic discrimination: Final progress report.** Eunice Kennedy Shriver Center for Mental Retardation, Inc., Waltham, MA (United States). Div. of Medical Genetics. [1994]. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-92ER61395. Order Number DE94013464. Source: OSTI; NTIS; GPO Dep.

We have screened 1006 respondents in a study of genetic discrimination. Analysis of these responses has produced evidence of the range of institutions engaged in genetic discrimination and demonstrates the impact of this discrimination on the respondents to the study. We have found that both ignorance and policy underlie genetic discrimination and that anti-discrimination laws are being violated.

5530 Agriculture and Food Technology

Refer also to citation(s) 28500, 28566

28538 (CONF-9404188--) **Joint USDA/DOE meeting.** Office of International Cooperation and Development (USDA), Washington, DC (United States). [1994]. 192p. Sponsored by USDOE, Washington, DC (United States). From Joint USDA/DOE meeting; Beltsville, MD (United States); 11-12 Apr 1994. Order Number DE94014983. Source: OSTI; NTIS; GPO Dep.

This documents contains the details from the USDA/USDOE meeting on April 11--12, 1994. Topics discussed include: genetic research, environmental research, renewable energy sources, food supply, improved fertilizers, new pesticides, research programs combining the efforts of the two agencies to develop new products for use in the agriculture industry, environmentally safe products, getting more with less money, and various other subjects dealing with how cooperation among these agencies can improve the agriculture industry.

28539 (OAEP-1-110) **Rearing larvae of the oriental fruit fly, Dacus Dorsalis Hendel on media containing banana or rice bran.** Poramarcom, R. (Office of Atomic Energy for Peace, Bangkok (Thailand)); Mitchell, S. Office of Atomic Energy for Peace, Bangkok (Thailand). Dec 1983. 15p. (In Thai). Order Number DE94632340. Source: OSTI; NTIS (US Sales Only); INIS.

Materials available in Thailand were substituted for some of those in the standard medium currently used in rearing larvae of Dacus dorsalis Hendel at the Tropical Fruit and Vegetable Research Laboratory, Honolulu, Hawaii. The purpose of this study is to decrease rearing costs through medium modification in Thailand. Larvae were reared in different media: three media containing banana and the other three containing rice bran, as the main ingredient. Wheat germ flakes and torula yeast were added to at: (1) 7.2 and 3.6% (2) 7.2 and 7.2% and (3) 10.8 and 7.2% by weight respectively. The standard medium comprised the seventh medium. The results showed that higher mean pupal recovery, higher mean pupal weight, and higher mean percentage of adult eclosion were obtained from media containing banana compared to media without banana. Media containing banana, (3) and (1), resulted in a significantly (P=0.05) higher mean pupal recovery, 57.49 and 56.88% respectively. Media containing banana, (2) and (3), resulted in the highest mean pupal weight, 12 and 11.68 mg. respectively. Media containing banana produced pupae with highest percentage of adult eclosion. No significant difference was observed in fecundity and fertility of flies reared in all media. Torula yeast and/or wheat germ flakes did not increase the number or weight of pupae. This study showed that media containing banana was the most suitable media for rearing D. dorsalis larvae. All three media containing rice bran were unsuitable for rearing this insect.

28540 (OAEP-1-114) **Effects of gamma radiation on various stages in the life cycle of meal worm, Tenebrio molitor Lin.** Chiravathanapong, S.; Segsarnviriya, S. Office of Atomic Energy for Peace, Bangkok (Thailand). Dec 1984. 22p. (In Thai). Order Number DE94632341. Source: OSTI; NTIS (US Sales Only); INIS.

Effect of gamma radiation on each growth stage of meal worm (Tenebrio molitor Lin.) were conducted at 27+-2^{0}C and 75+-2% relative humidity. LD_{50} and LD_{99} of 5-day old eggs at 5 days after irradiation were 76 and 367 gray. The survived larvae could live no longer than 5 days and seldom moved or without feeding. LD_{50} and LD_{99} of last instar larvae at 10 days after irradiation were 662 and 1,367 gray. No pupation occurred in larvae after irradiation. Dead larvae caused by radiation turned blackish, liquid oozed out from the body, and survived no longer than 5 days. Some irradiated larvae had incomplete molting and died. LD_{50} and LD_{99} of 6-day-old pupae at 3 days after irradiation were 874 and 1,492 gray. Abnormal irradiated pupae, some abnormal pupae were underdeveloped wing and abdominal pupal characteristic was still remained. Pupal legs could develop to adult legs only and could survive no longer than 1 week. Unfortunately pupae irradiated at low dosage of radiation would develop to be complete adult head, but could survive no longer than 2 weeks with slow movement and no oviposition. LD_{50} of male adults and female adults was checked in 7 days postirradiation and it was estimated as 788 and 786 gray while LD_{99} was estimated as 1,375 and 1,350 gray respectively. Results of male adults and female adults checking in 10 days postirradiation found that LD_{50} was estimated as 533 and 598 gray and LD_{99} was estimated as 1,227 and 1,229 gray respectively. The remained survivors of both sexes could survive no longer than 10 days without feeding and mating.

28541 (OAEP-1-115) **Fluorescent powders for marking oriental fruit flies (Dacus dorsalis Hendel).** Sutantawong, M. Office of Atomic Energy for Peace, Bangkok (Thailand). Dec 1984. 12p. (In Thai). Order Number DE94632342. Source: OSTI; NTIS (US Sales Only); INIS.

Marking insect techniques for the study of dispersal, migration, population density and longevity should have little or no detrimental effects on the insects. This experiment was conducted to study the effects of 4 day-glo^R fluorescent powders for marking oriental fruit flies (Dacus dorsalis Hendel), on mating ability, adult eclosion,

longevity, efficiency and persistence. Laboratory reared oriental fruit fly pupae, 2 days before emergence, were marked with neon red, arc yellow, blaze orange and signal green at 2g/liter of pupae. The results showed that there were no significantly different ($P<0.05$) in mating ability, adult eclosion and longevity between marked and unmarked flies. In addition, all fluorescent powders gave 100 per cent marking efficiency at emergence and at 7 days. There was a slightly decrease of fluorescent powders found on insects at 14 days.

28542 (OAEP–1-118) **Control of fruit flies by sterile insect technique. I. Population fluctuation studies of oriental fruit fly (Dacus dorsalis Hendel and Dacus zonatus Saunders) and micro climates at Royal Ang Khang Highland Research Station Chiang Mai.** Chiravathanapong, S. Office of Atomic Energy for Peace, Bangkok (Thailand). Dec 1984. 15p. (In Thai). Order Number DE94632343. Source: OSTI; NTIS (US Sales Only); INIS.

The studies of population fluctuation of male oriental fruit fly, (Dacus dorsalis Hendel) and [Dacus zontanus (Saunders)] and micro climate at Royal Ang Khang Highland Research Station Chiang Mai in 1983 were conducted. It was found that population of Dacus zonatus was rather high and almost seemed equal to that of Dacus dorsalis. Population of these two species increased at the beginning of February. Population of Dacus zonatus increased rapidly and reached the peak in the middle of May and of June. The number at peaks were 103 males and 87 males/trap/day respectively. However, the population of Dacus dorsalis increased slowly and followed the pattern of Dacus zonatus until the beginning of June, after that, the population increased rapidly and reached the peak in the middle of July. The number at peak was 240 males/trap/day. Later on they dropped rapidly in the middle of August, then the population of the two species fluctuated together. Finally they decreased down to near zero in November, December and January of the following year. In summary, population density of the said two species adult flies were rather high from the end of winter (the beginning of February) to the middle of raining season (July) and this period coincided with the time of fruit development in many introduced varieties (peach, persimmon, apple, pear and plum).

28543 (THAI-AEC–15) **Studies on the use of gamma radiation in the control of Pea Weevil, Callosobruchus chinensis L.** Office of Atomic Energy for Peace, Bangkok (Thailand). 1968. 18p. (In Thai). Order Number DE94632344. Source: OSTI; NTIS (US Sales Only); INIS.

At an average temperature of 27.5°C without any control on humidity, the life-cycle of pea weevils, Callosobruchus chinesis L. was between 21-26 days. When 1 day-old adults were used to observe the rate of oviposition, it was found that about 88-96 percent of eggs were deposited within 2-3 days. Gamma radiation could retard the development of eggs, larvae and pupae. A dose of 32,000 rads caused 100 percent mortality in pupae. The estimated LD_{50} was about 6,400 rads. In cases of pre pupae and late larvae, 100 percent mortality was obtained with a dose of 16,000 rads. The LD_{50} of 7 day-old, 4 day-old, 2 day-old and 1 day-old eggs were estimated as 1,240, 620, 380 and 340 respectively. Doses of 1,400-2,800 rads caused 99.9% sterility in eggs when both parents were exposed at the latest-pupal stage. A dose of 1,400 rads caused 99.9% sterility in eggs and 2,800 rads caused 100% sterility in eggs when both parents were exposed at early-adult stage. The surviving adults exposed at either latest-pupal or early-adult stage appeared normal and reduction in eggs was noticed. When both sexes were exposed at late larval, pre pupal and pupal stage, the female parents appeared more susceptible than the male in all cases. The long range effect of radiation on pea weevils was also studied. When parents were exposed at the pupal stage, the percentage sterility of eggs deposited by female parents was 71.0, by F_1 was 15.7, by F_2, F_3 and F_4 was 0. The feeding of adult pea weevils was evaluated by observations and by weighing the bean after feeding. It was found that no feeding took place.

28544 (THAI-AEC–18) **A study on the life cycle and the effect of radiation on rice weevil, sitophilus oryzae L.** Office of Atomic Energy for Peace, Bangkok (Thailand). 1968. 18p. (In Thai). Order Number DE94632345. Source: OSTI; NTIS (US Sales Only); INIS.

Studies on the life cycle and the effect of radiation on rice weevil, Sitophilus oryzae L. were made. Each stage of development of rice weevil was determined. The egg, larval and pupal stage was 7-9, 13-17 and 7-11 days respectively. The highest rate of oviposition was at 3-6 days. Rice weevils in different stages were exposed to various doses of gamma-radiation and the effects were recorded. It was observed that the males were more susceptible to radiation than females. A dose of 3500-5000 rads induced sterility in adult stage and no hatchability was observed at a dose of 5000 rads. The LD_{50} in egg, larval, pupal and adult stage was 15, 120, 1300 and 28400 rads respectively. The response of adult weevils to gamma radiation obtained from Co-60 and the reactor (U^{235}) appeared nearly the same. No radioresistance was observed in the second and third generations of rice weevils when adult parents were irradiated at a dose of 2500 rads. There was no recovery of germ cells in male insects following radiation exposure of about 5000 rads. A decrease in the population of rice weevils was noted when the irradiated males were introduced to mate with the non-irradiated females. The Sterile Male Release Technique could be well applied to reduce the number of rice weevils in storage places.

56 BIOMEDICAL SCIENCES, APPLIED STUDIES

5601 Radiation Effects

Refer also to citation(s) 27288, 27439, 27458, 27461, 27462, 27681, 28326, 28473, 28520, 28521, 28768, 28960

28545 (ANL/BIM/PP–73457) **Thorium isotopes in human tissues.** Stehney, A.F.; Lucas, H.F. Argonne National Lab., IL (United States). [1991]. 16p. Sponsored by USDOE, Washington, DC (United States);Nuclear Regulatory Commission, Washington, DC (United States). DOE Contract W-31109-ENG-38. Order Number DE94016388. Source: OSTI; NTIS; GPO Dep.

Concentrations of ^{232}Th and activity ratios of ^{228}Th to ^{232}Th and ^{230}Th to ^{232}Th were determined in autopsy samples from five former employees of a thorium refinery. The ranges of ^{232}Th activity concentrations (mBq g^{-1}) were 0.17–94 in lungs, 3.9–1210 in pulmonary lymph nodes, 0.14–1.19 in bones, 0.015–0.68 in liver, 0.97–5.8 in spleen, and 0.009–0.068 in kidneys. These concentrations are 10 to 1000 times greater than have been reported for persons not occupationally exposed to Th. In most of the samples, the ratios of ^{230}Th to ^{232}Th and ^{228}Th to ^{232}Th activity at death of the subject were 0.1–0.2 and 0.2–0.4, respectively. Thorium-228 to ^{228}Ra activity ratios ($\pm$ standard errors) of 0.86 $\pm$ 0.11 in lungs and 1.18 $\pm$ 0.13 in lymph nodes of one subject were obtained by calculation from ratios of ^{228}Th to ^{232}Th.

28546 (ANL/BIM/PP–78690) **DNA damage produced by exposure of supercoiled plasmid DNA to high- and low-LET ionizing radiation: Effects of hydroxyl radical quenchers: DNA breakage, neutrons, OH radicals.** Peak, J.G. (Argonne National Lab., IL (United States)); Ito, T.; Peak, M.J.; Robb, F.T. Argonne National Lab., IL (United States). [1994]. 32p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. Order Number DE94016382. Source: OSTI; NTIS; INIS; GPO Dep.

A supercoiled plasmid of 7300 base pairs was isolated and exposed in an aqueous environment to ^{60}Co γ rays and JANUS 0.85 MeV fission-spectrum neutrons. Dose responses for the production of single-strand breaks (SSBs), double-strand breaks (DSBs) and alkali-labile sites (ALSs) were compared with computations made from the conversion of the supercoil to its relaxed and linear forms. The relative biological effectiveness (RBE) for production of SSBs and DSBs was similar to that previously measured in the cellular environment. The RBE for destruction of genetic transforming activity of M13 viral DNA followed that for DNA damage. This is in contrast to the situation for biological effects such as lethality, mutagenesis, and cellular transformation measured in mammalian cells, where the RBE values are reversed. The role of hydroxyl (OH) radical in DNA damage induction by neutrons was investigated by exposure of plasmid in the presence of known quenchers

of this species. Of four quenchers tested, all were able to reduce the yields of both SSBs and DSBs. These findings are consistent with a model for SSB and DSB induction by high linear energy transfer that involves OH radical mediation.

28547 (ANL/BIM/PP–78778) **Protection against radiation-induced mutations at the hprt locus by spermine and N,N''-(dithiodi-2,1-ethanediyl)bis-1,3-propanediamine (WR-33278): WR-33278 and spermine protect against mutation induction.** Grdina, D.J.; Shigematsu, N.; Schwartz, J.L. Argonne National Lab., IL (United States). [1994]. 23p. Sponsored by US-DOE, Washington, DC (United States);Department of Health and Human Services, Washington, DC (United States). DOE Contract W-31109-ENG-38. Grant CA-37435. Order Number DE94016383. Source: OSTI; NTIS; INIS; GPO Dep.

The polyamine spermine and the disulfide N,N''-(dithiodi-2,1-ethanediyl)bis-1,3-propanediamine (WR-33278) are structurally similar agents capable of binding to DNA. WR-33278 is the disulfide moiety of the clinically studied radioprotective agent S-2-(3-aminopropylamino)ethylphosphorothioic acid (WR-2721). Because of their reported structural and functional similarities, it was of interest to characterize and compare their radioprotective properties using the endpoints of cell survival and mutation induction at the hypoxanthine-guanine phosphoribosyl transferase (hprt) locus in Chinese hamster AA8 cells. In order to facilitate both the uptake of WR-33278 into cells and the direct comparison between the protective properties of WR-33278 and spermine, these agents (at concentrations of 0.01 mM and 0.001 mM) were electroporated into cells. The exposure of cells to both electroporation and irradiation gave rise to enhanced cell killing and mutation induction, with the sequence of irradiation followed 3 h later by electroporation being the more toxic protocol. Enhanced cell survival was observed following electroporation of 0.01 mM of spermine and WR-33278 30 min prior to irradiation; protection factors (PF) of 1.3 and 1.8, respectively. Neither agent was protective at a concentration of 0.001 mM. Protection against radiation-induced hprt mutations was observed for both spermine and WR-33278 under all experimental conditions tested. These data suggest that the properties of radioprotection and chemoprevention exhibited by the phosphorothioate (WR-2721) and associated aminothiol (WR-1065) and disulfide (WR-33278) metabolites may be mediated via endogenous spermine-like polyamine processes. Such a mechanism would have important implications with respect to the design and development of new generation drugs for use in radioprotection and chemoprevention.

28548 (CEA-CONF–11664) **Occupational exposure to natural sources of radiation.** Ortiz, T. (Empresa Nacional de Residuos Radiactivos, SA (Spain)); Sciocchetti, G.; Rannou, A. CEA Centre d'Etudes de Fontenay-aux-Roses, 92 (France). Inst. de Protection et de Surete Nucleaire. 1993. 13p. (CONF-9310335–: International conference on 'Harmonization in radiation protection: from theory to practical applications', Taormina (Italy), 11-13 Oct 1993). Order Number DE94632366. Source: OSTI; NTIS (US Sales Only); INIS.

The most important natural sources of radiation are analyzed. The situation in France, Italy, and Spain concerning protection against natural radiation is described, including the identification of sources, and defined practices, organizations charged of national surveys and the responsibility of regulatory bodies and the role of operating management. The activities of the international organizations (ICRP, CEC and IAEA) are presented and discussed, and existing actions toward harmonization in the CEC, IAEA and other international programs is also discussed. (R.P.) 23 refs., 2 tabs.

28549 (CEA-CONF–11717) **Dose rate and LET spectrum aboard MIR station since ANTARES until ALTAIR mission.** Bottollier-Depois, J.F. (CEA Centre d'Etudes de Fontenay-aux-Roses, 92 (France). Inst. de Protection et de Surete Nucleaire); Nguyen, V.D.; Lebaron-Jacobs, L.; Siegrist, M.; Andre-Deshays, C.; Marsal, O.; Petrov, V.M.; Koslova, S.B.; Tognini, M.; Avdeev, SCEA Centre d'Etudes de Fontenay-aux-Roses, 92 (France). Inst. de Protection et de Surete Nucleaire. 1993. 4p. (CONF-9309395–: 5. European conference on the science of life in space, Arcachon (France), 26 Sep - 1 oct 1993). Order Number DE94632373. Source: OSTI; NTIS (US Sales Only); INIS.

The NAUSICAA system is installed aboard the Russian orbital station MIR since the French-Russian joint mission ANTARES. Data are available until the ALTAIR mission. Interesting results about radiation measurements show the South Atlantic Anomaly (SAA) crossing, the increase of radiation near the poles, the solar eruptions effects. These data give also a precise idea about the dose and the quality factor of the radiation received by the cosmonauts during different missions. (authors) 10 refs., 13 figs., 1 tab.

28550 (DOE/ER/60634–T5) **Theory of RBE: Annual technical progress report, 1 January–31 December, 1994.** Katz, R. Nebraska Univ., Lincoln, NE (United States). Dept. of Physics. 15 Jun 1994. 7p. Sponsored by USDOE, Washington, DC (United States);National Aeronautics and Space Administration, Washington, DC (United States). DOE Contract FG02-88ER60634. Order Number DE94015654. Source: OSTI; NTIS; INIS; GPO Dep.

In researching the theory of RBE, attention is focused on several topics of importance. They include: improving knowledge of the radial distribution of dose about the path of an energetic heavy ion in different media; calculations which have demonstrated that three Escherichia coli mutants behave as 1-hit detectors; lethal mutations in a nematode induced by gamma radiation and heavy ion beams; prevalence in cancer induction in the Harderian gland by HZE particles; subtleties in the analysis of radiobiological data; low-dose irradiation effects; high LET effects; cellular radiosensitivity parameters; and radial dose calculations for mammalian cells.

28551 (DOE/SR/18217–3) **Cancer and birth defects surveillance system for communities around the Savannah River Site: Annual progress report.** Dunbar, J.B. Medical Univ. of South Carolina, Charleston, SC (United States). May 1994. 101p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG09-91SR18217. Order Number DE94017158. Source: OSTI; NTIS; INIS; GPO Dep.

The US DOE funded this grant to the Medical University of South Carolina for a cancer and birth defects registry for an initial three year period which was completed as of April 29, 1994. While this Technical Progress Report is prepared principally to document the activities of year 03, it also summarizes the accomplishments of the first two years in order to put into perspective the energy and progress of the program over the entire three year funding cycle.

28552 (FRCEA-TH–401) **Study of interfacial phenomena of organo-chlorinated steam adsorption on a microporous adsorbent. Case of tri chloro-1,1,1 ethane on activated charcoal.** Escallon, S. CEA Centre d'Etudes de la Vallee du Rhone, 26 - Pierrelatte (France). Dept. de Technologie de l'Enrichissement; Montpellier-2 Univ., 34 (France). Jun 1991. 212p. (In French). Order Number DE94632368. Source: OSTI; NTIS (US Sales Only); INIS.

This study involves the construction and the perfecting of a test system for evaluating the service life of organic vapor cartridges versus 1,1,1 -trichloroethane. Thermogravimetric measurements were carried on in order to suggest a field method to reactive these cartridges, using hot air flow system. Assessment of adsorption rate during experiment is measured with a new electrical method. (author).

28553 (FRCEA-TH–414) **Experimental study of Americium-241 biokinetics in Homarus Gammarus lobster. Analysis of the accumulation and detoxication mechanisms at the sub-cellular level.** Paquet, F. CEA Centre d'Etudes de Fontenay-aux-Roses, 92 (France). Dept. de Protection de l'Environnement et des Installations; Nantes Univ., 44 (France). Dec 1991. 401p. (In French). Order Number DE94632323. Source: OSTI; NTIS (US Sales Only); INIS.

The Americium 241 radioelement accumulation and elimination rate and mechanisms in the lobster organism have been experimentally studied; incorporation and detoxification capacities of each organ are evaluated. The existence of various biological compartments is shown; the major role of the digestive gland in accumulation of the radioelement, its distribution towards the various organs, and its resorption is comprehensively described, with an analysis at the subcellular and molecular levels. 401 p., 65 fig., 43 tab., 428 ref.

28554 (JINR-R–16-92-190) **Quantities for radiation protection control.** Komochkov, M.M. Joint Inst. for Nuclear Research, Dubna (Russian Federation). Dept. of Radiation Safety. 1992. 19p. (In Russian). Order Number DE94632374. Source: OSTI; NTIS (US Sales Only); INIS.

Recommended by the International Commission on Radiological Protection in 1991 (Publication 60), the International Commission on Radiation Units and Measurements (Reports 39 and 43) and reglamented NRB-76/87, quantities for determining the consequences and control of ionizing radiation exposure have been described. The quantities have been intercomparized on the schematic hierarchical basis. The correlation and subordination of the quantities have been schown in clear form; the transition from one quantity to another has been recommended taking account of other limit values. 11 refs.; 2 figs.

28555 (LA–12818-MS) **Radionuclide concentrations in game and nongame fish upstream and downstream of Los Alamos National Laboratory: 1981 to 1993.** Fresquez, P.R.; Armstrong, D.R.; Salazar, J.G. Los Alamos National Lab., NM (United States). Aug 1994. 22p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. Order Number DE94016442. Source: OSTI; NTIS; INIS; GPO Dep.

Radionuclide concentrations were determined in game (surface-feeding) and nongame (bottom-feeding) fish collected from reservoirs upstream (Abiquiu, Heron, and El Vado) and downstream (Cochiti) of Los Alamos National Laboratory from 1981 to 1993. The average levels of ^{90}Sr, ^{137}Cs, ^{238}Pu, and ^{239}Pu in game and nongame fish collected from Cochiti reservoir were not significantly different in fish collected from reservoirs upstream of the Laboratory. Total uranium was the only radionuclide that was found to be significantly higher n both game and nongame fish from Cochiti as compared to fish from Abiquiu, Heron, and El Vado. Uranium concentrations in fish collected from Cochiti, however, significantly decreased from 1981 to 1993, and no evidence of depleted uranium was found in fish samples collected from Cochiti in 1993. Based on the average concentration of radionuclides over the year the effective (radiation) dose equivalent from consuming 46 lb of game fish and nongame fish from Cochiti reservoir after natural background has been subtracted was 0.005 and 0.009 mrem/yr, respectively. The highest dose was <0.01% of the International Commission on Radiological Protection (ICRP) permissible dose limit for protecting members of the public.

28556 (OAEP–1-113) **Environmental radioactivity monitoring for radiation protection during 1961-1982.** Mahapanyawong, S.; Milintawisamai, M.; Biramontri, S.; Prempeerakul, Y.; Polphong, P.; Wanabongse, P.; Wangcharoenroong, B.; Rativanich, N. Office of Atomic Energy for Peace, Bangkok (Thailand). Dec 1984. 35p. (In Thai). Order Number DE94632375. Source: OSTI; NTIS (US Sales Only); INIS.

This report describes the work on environmental radioactivity monitoring which has been conducted since 1961. The work encompasses the measurement of gross beta radioactivity, strontium-90 and caesium-137 in air, water, rain water, fallout, soil, grass, vegetable and in some types of meat. The samples were collected from various locations covered all regions of the country. This work is aimed to ensure public health safety from radiation hazard due to the operation of the nuclear research reactor and nuclear weapon tests. The results show the level of radioactivity in the investigated samples are within the safety limit.

28557 (OAEP–1-147) **Monitoring on air tritium in gas tight area.** Thuntawewadtananon, D.; Jerachanchai, S.; Siripirom, L.; Siasakul, K.; Suntarapai, P. Office of Atomic Energy for Peace, Bangkok (Thailand). Aug 1988. 17p. (In Thai). Order Number DE94632376. Source: OSTI; NTIS (US Sales Only); INIS.

Tritium monitoring of effluent streams from operating nuclear reactor is required to minimize such releases. A study was conducted in which an air tritium monitoring method was using silica gel desiccant. Results of the study include the development of a procedure to monitor in air for tritium using silica gel to collect the moisture, measurement of tritium in gas tight area, beam room and the fifth floor of the office building. The tritium concentrations were varied from 0.390 to 9.928 Bq/m^3 of air that is five times lower than derive air concentration of tritium.

28558 (OAEP–2-1) **Gross beta, gross alpha radioactivities and radium-226 in fresh water from various water resources in Thailand.** Pornthepkasemsan, B.; Kamonrat, K.; Sinakhom, F. Office of Atomic Energy for Peace, Bangkok (Thailand). Dec 1982. 85p. (In Thai). Order Number DE94632377. Source: OSTI; NTIS (US Sales Only); INIS.

This is a progress report of the first three years of study from January, 1978 to January, 1981. The objective of this study is to ascertain the value of gross alpha, gross beta radioactivities and the content of radium-226 in water from various parts of Thailand. Then, the baseline level of radioactivity in water will be established. Besides, the Thai Industrial Standards Institute, the Ministry of Industry will utilize these values for establishing the standard maximum permissible concentration of radioactivity in drinking water adding to the physical and chemical standards that already cited.

28559 (PNL–9983) **Pacific Northwest Laboratory ALARA Report for Calendar Year 1993.** Keller, S.L. Pacific Northwest Lab., Richland, WA (United States). Jul 1994. 19p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE94015995. Source: OSTI; NTIS; INIS; GPO Dep.

This report provides summary results of the Calendar Year (CY) 1993 As Low As Reasonably Achievable (ALARA) Program at the Pacific Northwest Laboratory (PNL). This report includes information regarding whole-body exposures to radiation, and skin contaminations. The collective whole-body radiation dose to employees during 1993 was 0.58 person-sievert (58 person-rem). This dose was 11 percent lower than the projected dose of 0.65 person-sievert (65 person-rem). The Radiation Protection Section's Field Dosimetry Services group projected that no PNL employee's dose would exceed 0.02 sievert (2 rem) based on dosimeters processed during the year; no worker actually exceeded the limit by the end of CY 1993. There were 15 reported cases of skin contamination for PNL employees during 1993. This number of 60 percent of the projected total of 25 cases. There were an additional 21 cases of personal-effects contamination to PNL staff: Nine of these contamination events occurred at the 324 Building, nine occurred at the 325 Building, one occurred in the 327 Building, one occurred in the 3720 Building, and one occurred in the 326 Building. Line management set numerous challenging and production ALARA goals for their facilities. Appendix A describes the final status of the 1993 ALARA goals. Appendix B describes the radiological ALARA goals for 1994. The Radiation Protection Section of the Laboratory Safety Dept. routinely perform audits of radiological ALARA requirements for specific facilities with significant potential for exposure. These ALARA audits are part of a comprehensive safety audit of the facility, designed to evaluate and improve total safety performance.

28560 (PNL-SA–24153) **Dosimetry of inhaled radon and thoron progeny.** James, A.C. Pacific Northwest Lab., Richland, WA (United States). Jun 1994. 25p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. (CONF-9406107–4: 1994 Health Physics Society (HPS) summer school on internal dosimetry, Davis, CA (United States), 6 Jun 1994). Order Number DE94015196. Source: OSTI; NTIS; INIS; GPO Dep.

This chapter reviews recent developments in modeling doses received by lung tissues, with particular emphasis on application of ICRP's new dosimetric model of the respiratory tract for extrapolating to other environments the established risks from exposure to radon progeny in underground mines. Factors discussed include: (1) the influence of physical characteristics of radon progeny aerosols on dose per unit exposure, e.g., the unattached fraction, and the activity-size distributions of clustered and attached progeny; (2) the dependence of dose on breathing rate, and on the exposed subject (man, woman or child); (3) the variability of dose per unit exposure in a home when exposure is expressed in terms of potential α energy or radon gas concentration; (4) the comparative dosimetry of thoron progeny; and (5) the effects of air-cleaning on lung dose. Also discussed is the apparent discrepancy between lung cancer risk estimates derived purely from dosimetry and the lung cancer incidence observed in the epidemiological studies of radon-exposed underground miners. Application of ICRP's recommended risk factors appears to overestimate radon lung-cancer

risk for miners by a factor of three. "Normalization" of the calculated effective dose is therefore needed, at least for α dose from radon and thoron progeny, in order to obtain a realistic estimate of lung cancer risk.

28561 (PNL-SA–24192) **From "micro" to "macro" internal dosimetry.** Fisher, D.R. Pacific Northwest Lab., Richland, WA (United States). Jun 1994. 28p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. (CONF-9406107–3: 1994 Health Physics Society (HPS) summer school on internal dosimetry, Davis, CA (United States), 6 Jun 1994). Order Number DE94015002. Source: OSTI; NTIS; INIS; GPO Dep.

Radiation dose is the amount of radiation energy deposited per unit mass of absorbing tissue. Internal dosimetry applies to assessments of dose to internal organs from penetrating radiation sources outside the body and from radionuclides taken into the body. Dosimetry is essential for correlating energy deposition with biological effects that are observed when living tissues are irradiated. Dose-response information provides the basis for radiation protection standards and risk assessment. Radiation interactions with living matter takes place on a microscopic scale, and the manifestation of damage may be evident at the cellular, multi-cellular, and even organ levels of biological organization. The relative biological effectiveness of ionization radiation is largely determined by the spatial distribution of energy deposition events within microscopic as well as macroscopic biological targets of interest. The spatial distribution of energy imparted is determined by the spatial distribution of radionuclides and properties of the emitted charged-particle radiation involved. The nonuniformity of energy deposition events in microscopic volumes, particularly from high linear energy transfer (LET) radiation, results in large variations in the amount of energy imparted to very small volumes or targets. Microdosimetry is the study of energy deposition events at the cellular level. Macrodosimetry is a term for conventional dose averaging at the tissue or organ level. In between is a level of dosimetry sometimes referred to as multi-cellular dosimetry. The distinction between these terms and their applications in assessment of dose from internally deposited radionuclides is described.

28562 (SAND–93-0848) **Evaluation of population density and distribution criteria in nuclear power plant siting.** Young, M. (Sandia National Labs., Albuquerque, NM (United States). Accident Analysis and Consequence Assessment Dept.). Sandia National Labs., Albuquerque, NM (United States). Jun 1994. 46p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. Order Number DE94016769. Source: OSTI; NTIS; INIS; GPO Dep.

The NRC has proposed revisions to 10 CFR 100 which include the codification of nuclear reactor site population density limits to 500 people per square mile, at the siting stage, averaged over any radial distance out to 30 miles, and 1,000 people per square mile within the 40-year lifetime of a nuclear plant. This study examined whether there are less restrictive alternative population density and/or distribution criteria which would provide equivalent or better protection to human health in the unlikely event of a nuclear accident. This study did not attempt to directly address the issue of actual population density limits because there are no US risk standards established for the evaluation of population density limits. Calculations were performed using source terms for both a current generation light water reactor (LWR) and an advanced light water reactor (ALWR) design. The results of this study suggest that measures which address the distribution of the population density, including emergency response conditions, could result in lower average individual risks to the public than the proposed guidelines that require controlling average population density. Studies also indicate that an exclusion zone size, determined by emergency response conditions and reactor design (power level and safety features), would better serve to protect public health than a rigid standard applied to all sites.

28563 (STUK/ST-GUIDE–1.4) **Organization for the use of radiation.** Finnish Centre for Radiation and Nuclear Safety (STUK), Helsinki (Finland). 1993. 8p. Translation of the original text in Finnish which is published under the same guide number. Order Number DE94632369. Source: OSTI; NTIS; INIS.

The guide is valid from 1 January 1992 and will remain in force until further notice. It replaces the SS guide 5.2 issued on 30 May 1986.

In Finland according to section 18 of the Finnish Radiation Act (592/91), organizations running a radiation practice are required to give a description how the work is arranged when applying for a safety licence, naming the radiation safety officer and providing information about qualifications, tasks and responsibilities of persons involved in the use of radiation, and about other related arrangements. In this guide the organisatory arrangements required for the permission of the use of radiation in Finland are specified. The guide also includes instructions for measures which has to be taken care of in different kinds of use of radiation and the competence requirements for the persons in charge of the radiation safety.

28564 (STUK/ST-GUIDE–1.7) **Health surveillance of persons engaged in radiation work.** Finnish Centre for Radiation and Nuclear Safety (STUK), Helsinki (Finland). 1993. 8p. Translation of the original text in Finnish which is published under the same guide number. Order Number DE94632378. Source: OSTI; NTIS; INIS.

The guide is valid from 1 January 1992 and will remain in force until further notice.

The aims of the health surveillance of the workers engaged in radiation work prescribed in the section 33 of the Finnish Radiation Act (592/91) are: (1) to ensure that the workers are suitable for the radiation work, (2) to monitor the health of the workers during the radiation work, and (3) to define the implications to the health if the radiation exposure exceeding the prescribed maximum value or other abnormal exposure is suspected or observed. The health requirements related to radiation work, aspects to be considered in the health surveillance, and procedures relating to observed or suspected overexposure are defined in this guide.

28565 (STUK/ST-GUIDE–5.3) **Use of ionizing radiation in the teaching of physics and chemistry.** Finnish Centre for Radiation and Nuclear Safety (STUK), Helsinki (Finland). 1993. 11p. Translaton of the original text in Finnish which is published under the same guide number. Order Number DE94632370. Source: OSTI; NTIS; INIS.

The guide is valid from 1 February 1993 and will remain in force until further notice. It replaces the SS guide 5.3 issued on 10 April 1987.

The guide specifies the safety requirements for the use of radiation in school education as well as the principles regulating the use of radiation sources without the safety license referred to the Section 16 of the Finnish Radiation Act (592/91). The guide covers the use of radiation sources emitting ionizing radiation in elementary schools and high schools, as well as the use of radiation in the teaching of physics and chemistry in vocational training institutions and corresponding educational institutions. (3 refs.).

28566 (STUK/ST-GUIDE–12.1) **Radiation safety in mining and excavation work.** Finnish Centre for Radiation and Nuclear Safety (STUK), Helsinki (Finland). 1993. 12p. Translation of the original text in Finnish which is published under the same guide number. Order Number DE94632379. Source: OSTI; NTIS; INIS.

The guide is valid from 1 October 1992 and will remain in force until further notice.

The general radiation safety requirements in mining and underground excavation are presented in the guide. The guide deals mostly with radon (Rn 222) as in mines and underground excavations the dose for workers is mainly due to radon. The guide refers only to radon and radon concentration and not to radon daughters or alphaenergy concentration. The guide is based on the Finnish Radiation Act and the Radiation Degree. The instructions are in good accordance with the 1990 Recommendations of the International Commission on Radiological Protection (ICRP publication 60). (4 refs., 1 tab.).

5603 Chemicals Metabolism and Toxicology

Refer also to citation(s) 28398, 28400, 28493, 28497, 28514

28567 (PNL-SA–23736) **Pesticides and their effects on wildlife.** Driver, C.J. Battelle Pacific Northwest Lab., Richland, WA (United States). [1994]. 23p. DOE Contract AC06-76RL01830.

(CONF-940191–1: Northwest Alfalfa Seed Growers conference, Reno, NV (United States), 31 Jan - 1 feb 1994). Order Number DE94014493. Source: OSTI; NTIS; GPO Dep.

About 560 active ingredients are currently used as pesticides. Applications of these pesticides are made to agricultural lands and other areas inhabited by wildlife. Unfortunately, many agricultural-use pesticides also entail some measure of risk to organisms other than the pest species. Because testing of pesticides prior to registration cannot evaluate all the potential environmental-pesticide-wildlife/fish interactions, current methods of risk assessment do not always provide sufficient safety to nontarget organisms. This is evidenced by die-offs of fish and wildlife from applications of pesticides at environmentally "safe" rates, the linking of population declines of some species with agrochemical use, and observations of survival-threatening behavioral changes in laboratory and field animals exposed to typical field levels of pesticides. It is important to note, however, that the majority of pesticides, when properly applied, have not caused significant injury to wildlife. A brief summary of pesticide effects on wildlife and fish are presented for the common classes of pesticides in use today.

5604 Other Environmental Pollutant Effects

28568 (PNL-SA–24287) **Mechanisms of interaction and biological effects of extremely-low-frequency electromagnetic fields.** Tenforde, T.S. Pacific Northwest Lab., Richland, WA (United States). [1994]. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. (CONF-9406207–1: U.S.-Japan science seminar, Sapporo (Japan), 28 Jun - 1 jul 1994). Order Number DE94015200. Source: OSTI; NTIS; GPO Dep.

Evidence is mounting, that environmental electric and magnetic fields in the extremely-low-frequency (ELF) band below 300 Hz can influence biological functions by mechanisms that are only poorly understood at the present time. The primary objectives of this paper are to review the physical properties of ELF fields, their interactions with living systems at the tissue, cellular, and subcellular levels, and the key role of cell membranes in the transduction of signals from imposed ELF fields. Topics of discussion include signal-to-noise ratios for single cells and cell aggregates, resonance phenomena involving a combination of static and ELF magnetic fields, and the possible influence of ELF fields on molecular signaling pathways that involve membrane receptors and cytoplasmic second messengers. The implications of these findings for promotion of tumor growth by ELF fields are also reviewed.

57 HEALTH AND SAFETY

Refer also to citation(s) 28550

5701 Real Accidents

Refer also to citation(s) 27680

58 GEOSCIENCES

Refer also to citation(s) 27244, 27325, 27369, 27958, 28393, 28494, 28503, 28939

28569 (LA-UR–93-4416) **Modeling fracture in cemented granular material.** Trent, B.C.; Margolin, L.G. Los Alamos National Lab., NM (United States). [1993]. 16p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-941040–1: Application of fracture mechanics to geomaterials ASCE annual meeting, Atlanta, GA (United States), 6-14 Oct 1994). Order Number DE94004560. Source: OSTI; NTIS; GPO Dep.

We have conducted an extensive study to determine the underlying physical processes that govern inelastic behavior in brittle geologic materials. The distinct element method has been used to perform many different numerical experiments to help understand how permanent macroscopic deformations can be characterized in terms of microscopic parameters, such as fracture of binding material and topology of granular matrix. In particular, we have constructed a distinct element model of a cemented granular material which accounts for the elastic forces due to bonding between pairs of spherical particles, and which allows for the possibility of anisotropic damage to the bonds due to the growth of small brittle cracks within the bonds. We then develop a general constitutive theory that estimates the effective elastic moduli of a cemented granular material by applying statistical mechanical averaging to a purely micromechanical model. In this paper, we use the numerical model to validate the predictions of the theory for various prescribed patterns of damage. Specifically, we impose several anisotropic patterns of damage on the bonds of a randomly generated assembly of particles. We then do numerical experiments, sending both p-waves and s-waves through samples and measuring the wave velocities. Predictions of theory for these velocities agree well with results of the numerical model for a variety of damage patterns. We discuss the implications of our theory, as well as potential applications.

28570 (LA-UR–94-1668) **^{226}Ra and ^{231}Pa systematics of axial MORB, crustal residence ages, and magma chamber characteristics at 9–10°N East Pacific Rise.** Goldstein, S.J. (Los Alamos National Lab., NM (United States)); Murrell, M.T.; Perfit, M.R.; Batiza, R.; Fornari, D.J. Los Alamos National Lab., NM (United States). [1994]. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-9408102–1: VM Goldschmidt conference, Edinburgh (United Kingdom), 29 Aug - 2 sep 1994). Order Number DE94013084. Source: OSTI; NTIS; GPO Dep.

Mass spectrometric measurements of ^{30}Th-^{226}Ra and ^{235}U-^{231}Pa disequilibria for axial basalts are used to determine crustal residence ages for MORB magma and investigate the temporal and spatial characteristics of axial magma chambers (AMC) at 9–10°N East Pacific Rise (EPR). Relative crustal residence ages can be calculated from variations in ^{226}Ra/^{230}Th and ^{231}Pa/^{235}U activity ratios for axial lavas, if (1) mantle sources and melting are uniform, and mantle transfer times are constant or rapid for axial N-MORB, and (2) ^{231}Pa/^{235}U and ^{226}Ra/^{230}Th in the melt are unaffected by shallow level fractional crystallization. Uniform Th, Sr, and Nd isotopic systematics and incompatible element ratios for N-MORB along the 9–10°N segment indicate that mantle sources and transfer times are similar. In addition, estimated bulk solid/melt partition coefficients for U, Th, and Pa are small, hence effects of fractional crystallization on ^{231}Pa/^{235}U ratios for the melt are expected to be negligible. However, fractional crystallization of plagioclase in the AMC would lower ^{226}Ra/^{230}Th ratios in the melt and produce a positive bias in ^{226}Ra crustal residence ages for fractionated lavas.

28571 (UCRL-JC–116437) **Lithological and rheological constraints on fault rupture scenarios for ground motion hazard prediction.** Hutchings, L.; Foxall, W. Lawrence Livermore National Lab., CA (United States). 18 Apr 1994. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-9409167–1: International Union of Theoretical and Applied Mechanics symposium on mechanics problems in geodynamics, Beijing (China), 5-9 Sep 1994). Order Number DE94014742. Source: OSTI; NTIS; GPO Dep.

This paper tests an approach to predict the range of ground motion hazard at specific sites generated by earthquakes on specific faults. The approach is based upon structural, lithological and rheological descriptions of the fault zones, development of fault rupture scenarios, and computation of synthetic seismograms using empirical Green's functions. Faults are placed within a regional geomechanical model. The approach is based upon three hypothesis: (1) An exact solution of the representation relation that utilizes empirical Green's functions enables very accurate computation of ground motions generated by a given rupture; (2) a general description of the rupture is sufficient; and (3) the structural, lithological and Theological characteristics of a fault can be used to constrain, in advance, possible future rupture histories. Ground motion hazard here refers to three-component, full wave train descriptions of displacement, velocity, and acceleration over the frequency band 0.01 to 25 Hz. Corollaries to these hypotheses are that the range of possible fault rupture histories is narrow enough to functionally

constrain the range of strong ground motion predictions, and that a discreet set of rupture histories is sufficient to span the infinite combinations possible from a given range of rupture parameters.

28572 (UCRL-JC–117503) **Tomographic resolution without singular value decomposition.** Berryman, J.G. Lawrence Livermore National Lab., CA (United States). Jun 1994. 14p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-940723–5: Annual meeting of the Society of Photo-Optical Instrumentation Engineers, San Diego, CA (United States), 24-29 Jul 1994). Order Number DE94015136. Source: OSTI; NTIS; GPO Dep.

An explicit procedure is presented for computing both model and data resolution matrices within a Paige-Saunders LSQR algorithm for iterative inversion in seismic tomography. These methods are designed to avoid the need for an additional singular value decomposition of the ray-path matrix. The techniques discussed are completely general since they are based on the multiplicity of equivalent exact formulas that may be used to define the resolution matrices. Thus, resolution matrices may also be computed for a wide variety of iterative inversion algorithms using the same ideas.

66 PHYSICS

6610 General Physics

28573 (CERN–93-06) **The development of science during this century.** Weisskopf, V.F. (Massachusetts Inst. of Tech., Cambridge, MA (United States)). European Organization for Nuclear Research, Geneva (Switzerland). 20 Dec 1993. 18p. (CONF-9308209–: Conference on disarmament and arms limitation obligations: problems of compliance and enforcement, Geneva (Switzerland), 5-6 Aug 1993). Order Number DE94632964. Source: OSTI; NTIS (US Sales Only); INIS.

This is a slightly revised version of a talk delivered at the meeting of the American Association for the Advancement of Science, in Boston, on 14 February 1993, and at a CERN Colloquium, on 5 August 1993, entitled 'Science -yesterday, today and tomorrow'. It describes the tremendous growth of scientific knowledge and insights acquired since the beginning of this century. The changes in the character, sociology and support, of science are discussed, including the growing predominance of American science and the recent trend away from basic science towards applied research. (orig.).

6611 Classical and Quantum Mechanics

28574 (BONN-HE–94-05) **Generation of a quantum integrable class of discrete-time of relativistic periodic Toda chains.** Kundu, A. Bonn Univ. (Germany). Physikalisches Inst. Feb 1994. 8p. Order Number DE94786362. Source: OSTI; NTIS (US Sales Only); INIS.

A new integrable class of quantum models representing a family of different discrete-time or relativistic generalisations of the periodic Toda chain (TC), including that of a recently proposed classical close to TC model (P. L. Christiansen et al. (1993)) is presented. All such models are shown to be obtainable from a single ancestor model at different realisations of the underlying quantised algebra. As a consequence the (2x2) Lax operators and the associated quantum R-matrices for these models are easily derived ensuring their quantum integrability. It is shown that the functional Bethe ansatz developed for the quantum TC is trivially generalised to achieve separation of variables also for the present models. (orig.)

28575 (DESY–94-018) **Path integral discussion for Smorodinsky-Winternitz potentials. Pt. 1: Two- and three-dimensional Euclidean space.** Grosche, C. (Hamburg Univ. (Germany). 2. Inst. fuer Theoretische Physik); Pogosyan, G.S.; Sissakian, A.N. Deutsches Elektronen-Synchrotron (DESY), Hamburg (Germany). Feb 1994. 61p. Sponsored by Deutsche Forschungsgemeinschaft, Bonn (Germany). Contract DFG GR 1031/2-1. (HEP-TH–9402121). Order Number DE94789713. Source: OSTI; NTIS (US Sales Only); INIS.

Path integral formulations for the Smorodinsky-Winternitz potentials in two- and three-dimensional Euclidean space are presented. We mention all coordinate systems which separate the Smorodinsky-Winternitz potentials and state the corresponding path integral formulations. Whereas in many coordinate systems an explicit path integralformulation is not possible, we list in all soluble cases the path integral evaluations explicity in terms of the propagators and the spectral expansions into the wave-functions. (orig.)

28576 (DESY–94-058) **Periodic-orbit theory of the number variance Σ^2(L) of strongly chaotic systems.** Aurich, R. (Hamburg Univ. (Germany). 2. Inst. fuer Theoretische Physik); Steiner, F. Deutsches Elektronen-Synchrotron (DESY), Hamburg (Germany). Mar 1994. 26p. Sponsored by Deutsche Forschungsgemeinschaft, Bonn (Germany). Contract DFG Ste 241/4-6. Order Number DE94789619. Source: OSTI; NTIS (US Sales Only); INIS.

We discuss the number variance Σ^2(L) and the spectral form factor F(τ) of the energy levels of bound quantum systems whose classical counterparts are strongly chaotic. Exact periodic-orbit representations of Σ^2(L) and F(τ) are derived which explain the breakdown of universality, i.e., the deviations from the predictions of random-matrix theory. The relation of the exact spectral form factor F(τ) to the commonly used approximation K(τ) is clarified. As an illustration the periodic-orbit representations are tested in the case of a strongly chaotic system at low and high energies including very long-range correlations up to L=700. Good agreement between 'experimental' data and theory is obtained. (orig.)

28577 (FZR–42(prepr.)) **Description of an open quantum mechanical system.** Rotter, I. (Technische Univ. Dresden (Germany). Inst. fuer Theoretische Physik). Forschungszentrum Rossendorf e.V. (FZR), Rossendorf bei Dresden (Germany). May 1994. 29p. Order Number DE94789618. Source: OSTI; NTIS (US Sales Only); INIS.

A model for the description of an open quantum mechanical many-particle system is formulated. It starts from the shell model and treats the continuous states by a coupled channels method. The mixing of the discrete shell model states via the continuum of decay channels results in the genuine decaying states of the system. These states are eigenstates of a non-Hermitean Hamilton operator the eigenvalues of which give both the energies and the widths of the states. All correlations between two particles which are caused by the two-particle residual interaction, are taken into account including those via the continuum. In the formalism describing the open quantum mechanical system, the coupling between the system and its environment appears nonlinearly. If the resonance states start to overlap, a redistribution of the spectroscopic values ('trapping effect') takes place. As a result, the complexity of the system is reduced at high level density, structures in space and time are formed. This redistribution describes, on the one hand, the transition from the well-known nuclear properties at low level density to those at high level density and fits, on the other hand, into the concept of selforganization. (orig.)

28578 (IPNO-TH–92-17) **On the zeros of the Husimi functions of the spin boson model.** Cibils, M.B. (Neuchatel Univ. (Switzerland). Inst. de Physique); Cuche, Y.; Leboeuf, P.; Wreszinski, W.F. Paris-11 Univ., 91 - Orsay (France). Inst. de Physique Nucleaire. Mar 1992. 26p. Order Number DE94632965. Source: OSTI; NTIS (US Sales Only); INIS.

The distribution of zeros of the Husimi functions for the spin-boson model is studied, following an approach introduced by Leboeuf and Voros. The interest lies in the model's double feature of possessing both a classical integrable to chaotic transition and an unbounded four-dimensional phase space. The latter gives rise to several new questions regarding the Husimi zeros which are discussed and partially answered. Some significant results occur in spite of the fact that the case of spin one-half is treated. (authors) 20 refs., 4 figs.

28579 (LA-UR–94-1949) **Exact, E = 0, classical and quantum solutions for general power-law oscillators.** Nieto, M.M. (Los Alamos National Lab., NM (United States)); Daboul, J. Los Alamos National Lab., NM (United States). [1994]. 12p. Sponsored by USDOE, Washington, DC (United States). DOE Contract

W-7405-ENG-36. (CONF-9403139–1: Workshop on harmonic oscillators, Cocoyoc (Mexico), 23-25 Mar 1994). Order Number DE94014436. Source: OSTI; NTIS; INIS; GPO Dep.

For zero energy, E = 0, we derive exact, classical and quantum solutions for all power-law oscillators with potentials $V(r) = -\gamma/r^{\nu}$, $\gamma > 0$ and $-\infty < \nu < \infty$. When the angular momentum is non-zero, these solutions lead to the classical orbits $\rho(t) = [\cos \mu(\varphi(t) - \varphi_0(t))]^{1/\mu}$, with $\mu = \nu/2 - 1 \neq 0$. For $\nu > 2$, the orbits are bound and go through the origin. We calculate the periods and precessions of these bound orbits, and graph a number of specific examples. The unbound orbits are also discussed in detail. Quantum mechanically, this system is also exactly solvable. We find that when $\nu > 2$ the solutions are normalizable (bound), as in the classical case. Also, there are normalizable discrete, yet unbound, state which correspond to unbound classical particles which reach infinity in a finite time. These and other interesting comparisons to the classical system will be discussed.

28580 (SAND–94-1748C) **Magnetic field induced minigap in double quantum wells.** Simmons, J.A. (Sandia National Labs., Albuquerque, NM (United States)); Lyo, S.K.; Klem, J.F.; Harff, N.E. Sandia National Labs., Albuquerque, NM (United States). [1994]. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. (CONF-940847–1: Conference on the application of high magnetic fields, Cambridge, MA (United States), 8-12 Aug 1994). Order Number DE94015013. Source: OSTI; NTIS; INIS; GPO Dep.

We report discovery of a partial energy gap, or minigap, in strongly coupled double quantum wells (QWs), due to an anticrossing of the two QW dispersion curves. The anticrossing and minigap are induced by an in-plane magnetic field $B_{||}$, and give rise to large distortions in the Fermi surface and density of states, including a Van Hove singularity. Sweeping $B_{||}$ moves the minigap through the Fermi level, with the upper and lower gap edges producing a sharp maximum and minimum in the low-temperature in-plane conductance, in agreement with theoretical calculations. The gap energy may be directly determined from the data.

6612 Techniques of General Use In Physics

28581 (DOE/ER/54160–1-Vol.3, pp. 1907-1911) **Ionization of a high energy neutral beam propagating in the ionosphere.** Lai, S.T. (Phillips Lab., Hanscom, MA (United States)). Maryland Univ., College Park, MD (United States). [1992]. (CONF-920515–Vol.3: 9. international conference on high power particle beams, Washington, DC (United States), 25-29 May 1992). In *Beams 92: Proceedings: Volume 3, Microwaves, Free electron lasers, Advanced accelerators, Applications, and Plasma discharges.* 681p. Order Number DE94014785. Source: OSTI; NTIS; INIS.

By using modeled stripping ionization cross sections and standard atmospheric density models, the author calculates stripping ionization probability of high energy (MeV) neutral beams propagating in the earth's atmosphere. Numerical results as functions of altitude, beam angle and beam energy are presented. The author also considers Alfven's critical ionization velocity (CIV) process as an alternate ionization pathway. If CIV occurs as the neutral beam propagates through the geoplasma across the ambient magnetic field, it may be an important pathway to rapid ionization halting the beam. The author concludes that the parametric conditions are unfavorable for CIV to occur.

28582 (LAL-RT–92-01) **A versatile lattice for a tau-charm factory that includes a monochromatization scheme.** Faus-Golfe, A.; Le Duff, J. Paris-11 Univ., 91 - Orsay (France). Lab. de l'Accelerateur Lineaire. Feb 1992. 36p. Order Number DE94633033. Source: OSTI; NTIS (US Sales Only); INIS.

A double ring system with multibunch scheme and high luminosity is discussed. An attempt for beam monochromatization at the crossing point was made by increasing the vertical bending angle, and it succeeded in providing a proper matching. The next step consisted of demonstrating that the new ring geometry that permits a monochromatization scheme could be returned and rematched to operate without monochromatization, allowing only relocation of quadrupoles and readjustment of their gradient in the sloping region. The results of this work are reported after a brief recall of the monochromatization scheme requirements. (K.A.) 10 refs., 13 figs., 2 tabs.

28583 **Filtered cathodic arc source.** Falabella, S.; Sanders, D.M. To Dept. of Energy. 1992. Filed date 30 Jul 1992. U.S. Patent Application 7-921,780. 17p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. Order Number DE94016128. Source: OSTI; NTIS; GPO Dep.

Disclosed is a continuous, cathodic arc ion source coupled to a macro-particle filter capable of separation or elimination of macro-particles from the ion flux produced by cathodic arc discharge. The ion source employs an axial magnetic field on a cathode (target) having tapered sides to confine the arc, thereby providing high target material utilization. A bent magnetic field is used to guide the metal ions from the target to the part to be coated. The macro-particle filter consists of two straight solenoids, end to end, but placed at 45° to one another, which prevents line-of-sight from the arc spot on the target to the parts to be coated, yet provides a path for ions and electrons to flow, and includes a series of baffles for trapping the macro-particles.

6613 Other Aspects of Physical Science

Refer also to citation(s) 28052, 28637, 28868

28584 (CEA-CONF–11693) **Introduction to some basic aspects of NMR.** Goldman, M. CEA Centre d'Etudes de Saclay, 91 - Gif-sur-Yvette (France). Dept. de Recherche sur l'Etat Condense, les Atomes et les Molecules. 1992. 83p. (CONF-9210471–: International school of physics Enrico Fermi 'Nuclear magnetic double resonance', Varenna (Italy), 13-21 Oct 1992). Order Number DE94633038. Source: OSTI; NTIS (US Sales Only); INIS.

The principal interactions are reviewed that are experienced by nuclear spins making magnetic resonance feasible and which disturb it in a way that gives access to the properties of bulk matter. The interactions leading to NMR include Zeeman interaction, dipole-dipole interactions, and exchange interactions. Spin-lattice relaxation relevant to NMR is revisited next. It is followed by an overview of spin temperature. Finally, the care of periodic Hamiltonian is discussed in detail as another contribution to NMR. (R.P.) 48 refs., 12 figs.

28585 (LA-SUB–94-112) **Thermal blooming experiments: Final report.** Los Alamos National Lab., NM (United States); North East Research Associates, Inc., Woburn, MA (United States). May 1990. 26p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. Order Number DE94016567. Source: OSTI; NTIS; GPO Dep.

The goals of this program were to design an experiment for determining the effect of stimulated thermal Brillouin scattering (STBS) on single pulse laser propagation and to establish the ability of both a wave optics code and of linearized theory to predict the results of the experiment accurately. The second goal is particularly important because no experimental verification of analytical tools currently in use for single pulse high power laser propagation is available. When a high power laser propagates through the atmosphere, a small fraction of the laser energy is absorbed, creating acoustic waves that may move a significant distance transverse to the propagation direction during the pulse. Such waves lead to the well-known t^3-blooming refractive-index variations. When such blooming is sufficiently strong, the induced refractive-index alters the intensity profile of the beam farther along the propagation path. This altered intensity profile induces a somewhat different refractive-index profile that may reinforce the path-integrated t^3 blooming. This self-enhancement may be called near-forward stimulated thermal Brillouin scattering (STBS). The design effort described here was carried out much like the proposed experimental program, which calls for the interaction of experimental work with analytical theory and with a wave optics code, A linearized theory of STBS was developed. Results from this theory were compared to output from a wave optics propagation code for several well defined sets of operating conditions. Once good agreement between theory and code simulation was obtained for these test conditions, the theory was used to define and operating regime for a laboratory scale thermal blooming experiment that would provide

information relevant to high power laser propagation. A conceptual design for this experiment was then generated and, finally, and experimental set-up, including diagnostics, was proposed.

28586 (LA-UR–94-1587) **Early solar mass loss, element diffusion, and solar oscillation frequencies.** Guzik, J.A.; Cox, A.N. Los Alamos National Lab., NM (United States). [1994]. 14p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-9403143–1: Solar modeling workshop, Seattle, WA (United States), 21-24 Mar 1994). Order Number DE94014802. Source: OSTI; NTIS; GPO Dep.

Swenson and Faulkner, and Boothroyd et al. investigated the possibility that early main-sequence mass loss via a stronger early solar wind could be responsible for the observed solar lithium and beryllium depiction. This depletion requires a total mass loss of ~0.1 $M_\odot$, nearly independent of the mass loss timescale. We have calculated the evolution and oscillation frequencies of solar models including helium and element diffusion, and such early solar mass loss. We show that extreme mass loss of 1 $M_\odot$ is easily ruled out by the low-degree p-modes that probe the solar center and sense the steeper molecular weight gradient produced by the early phase of more rapid hydrogen burning. The effects on central structure are much smaller for models with an initial mass of 1.1 $M_\odot$ and exponentially-decreasing mass loss irate with e-folding timescale 0.45 Gyr. While such mass loss slightly worsens the agreement between observed and calculated low-degree modes, the observational uncertainties of several tenths of a microhertz weaken this conclusion. Surprisingly, the intermediate-degree modes with much smaller observational uncertainties that probe the convection zone bottom prove to be the key to discriminating between models: The early mass loss phase decreases the total amount of helium and heavier elements diffused from the convection zone, and the extent of the diffusion produced composition gradient just below the convection zone, deteriorating the agreement with observed frequencies for these modes. Thus it appears that oscillations can also rule out this smaller amount of gradual early main-sequence mass loss in the young Sun. The mass loss phase must be confined to substantially under a billion years, probably 0.5 Gyr or less, to simultaneously solve the solar Li/Be problem and avoid discrepancies with solar oscillation frequencies.

28587 (LA-UR–94-1588) **Production profiles of nuclides by galactic-cosmic-ray particles in small meteoroids.** Reedy, R.C.; Masarik, J. Los Alamos National Lab., NM (United States). [1994]. 4p. Sponsored by Department of Defense, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-940796–1: Workshop on meteorites from cold and hot deserts, Noerdlingen (Germany), 20-22 Jul 1994). Order Number DE94014801. Source: OSTI; NTIS; GPO Dep.

Short communication. COSMIC RADIATION/isotope production; METEOROIDS; GALAXIES; BERYLLIUM 10; CARBON 14

28588 (LA-UR–94-1610) **Geosynchronous orbit magnetopause crossings.** McComas, D.J.; Elphic, R.C.; Moldwin, M.B.; Thomsen, M.F. Los Alamos National Lab., NM (United States). [1994]. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-9406192–2: 8. international symposium on solar terrestrial physics, Sendai (Japan), 6-10 Jun 1994). Order Number DE94014817. Source: OSTI; NTIS; GPO Dep.

In this study we extend the analysis of magnetopause crossings observed with Magnetospheric Plasma Analyzer measurements to examine a much larger statistical data set. This study examines 39 maiznetosheath/LLBL intervals from 79 spacecraft-months of observations: these observations were taken from a survey of data from the start of each spacecraft mission and extending through March 1993. In contrast to the previous findings, we find no evidence for a significant dawn/dusk asymmetry in geosynchronous magnetopause crossings.

28589 (LA-UR–94-1616) **Numerical simulations of planetary gamma-ray spectra induced by galactic cosmic rays.** Masarik, J.; Reedy, R.C. Los Alamos National Lab., NM (United States). [1994]. 4p. Sponsored by National Aeronautics and Space Administration, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-940507–25: International conference on nuclear data for science and technology, Gatlinburg, TN (United States), 9-13 May 1994). Order Number DE94014809. Source: OSTI; NTIS; GPO Dep.

The fluxes of cosmic-ray-produced gamma rays escaping from Mars were calculated using the LAHET Code System and basic nuclear data for γ-ray production. Both surface water content and atmospheric thickness strongly affect the fluxes of γ-ray lines escaping from Mars.

28590 (LA-UR–94-2129) **An observational test of magnetospheric magnetic field mapping.** Weiss, L.A.; Thomsen, M.F.; Reeves, G.D.; Hones, E.W.; McComas, D.J. Los Alamos National Lab., NM (United States). [1994]. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-9406192–3: 8. international symposium on solar terrestrial physics, Sendai (Japan), 6-10 Jun 1994). Order Number DE94014461. Source: OSTI; NTIS; GPO Dep.

The distortion of the geomagnetic field is a key signature of the response of the magnetosphere to the solar wind input. A number of empirical models have been devised to estimate the magnetic field direction and magnitude at any point within the magnetosphere under a variety of conditions. We describe a technique whereby the field-line mapping predicted by such models is tested by matching measurements of magnetospheric plasma energy spectra obtained by Los Alamos instruments at geosynchronous orbit with spectra obtained by instruments on the polar-orbiting DMSP satellites (at an altitude of about 800 km) at times when the two satellites are in approximate magnetic conjugacy. With up to three geosynchronous satellites and as many as four DMSP satellites in operation at any given time, there are a very large number of such two-satellite conjunctions, allowing the model mappings to be tested under a wide range of local times and geomagnetic activity. Preliminary results from the application of this technique are presented for one week of data from March, 1991.

28591 (LA-UR–94-2307) **The MOXE X-ray all-sky monitor for Spectrum-X-Gamma.** In't Zand, J.J.M. (and others); Priedhorsky, W.C.; Moss, C.E. Los Alamos National Lab., NM (United States). [1994]. 15p. Sponsored by National Aeronautics and Space Administration, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-940723–10: Annual meeting of the Society of Photo-Optical Instrumentation Engineers, San Diego, CA (United States), 24-29 Jul 1994). Order Number DE94016064. Source: OSTI; NTIS; GPO Dep.

MOXE is an X-ray all-sky monitor to be flown on the Russian Spectrum-X-Gamma satellite, to be launched in a few years. It will monitor several hundred X-ray sources on a daily basis, and will be the first instrument to monitor most of the X-ray sky most of the time. MOXE will alert users of more sensitive instruments on Russia's giant high energy astrophysics observatory and of other instruments to transient activity. MOXE consists of an array of 6 X-ray pinhole cameras, sensitive from 3 to 25 keV, which views 4π steradians (except for a 20° × 80° patch which includes the Sun). The pinhole apertures of 0.625 × 2.556 cm^2 imply an angular resolution of 2°.4 × 9°.7 (on-axis). The MOXE hardware program includes an engineering model, now delivered, and a flight model. The flight instrument will mass approximately 118 kg and draw 38 Watts. For a non-focusing all-sky instrument that is limited by sky background, the limiting sensitivity is a function only of detector area. MOXE, with 6,000 cm^2 of detector area, will, for a 24 hrs exposure, have a sensitivity of approximately 2 mCrab. MOXE distinguishes itself with respect to other all-sky monitors in its high duty cycle, thus being particularly sensitive to transient phenomena with time scales between minutes and hours.

28592 (LA-UR–94-2612) **On orbit performance of the ALEXIS EUV telescopes.** Bloch, J. (and others); Edwards, B.; Priedhorsky, W. Los Alamos National Lab., NM (United States). [1994]. 14p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-940723–9: Annual meeting of the Society of Photo-Optical Instrumentation Engineers, San Diego, CA (United States), 24-29 Jul 1994). Order Number DE94016197. Source: OSTI; NTIS; GPO Dep.

The Array of Low Energy X-ray Imaging Sensors (ALEXIS) satellite is Los Alamos' first attempt at building and flying a low cost, rapid development, technology demonstration and scientific space

mission. The ALEXIS satellite contains the two experiments: the ALEXIS telescope array, (which consists of six EUV/ultrasoft x-ray telescopes utilizing multilayer mirrors, each with a 33 degree field-of-view), and a VHF ionospheric experiment called Blackbeard. A ground station located at Los Alamos exclusively controls the spacecraft. The 248 pound ALEXIS satellite was launched by a Pegasus booster into a 400 x 450 nautical mile, 70 degree inclination orbit on April 25, 1993. Images from a video system on the rocket indicated that ALEXIS had been severely damaged during launch with one of the 4 solar panels breaking away from its mounting. (It later turned out that the solar paddle was still attached to the spacecraft but only through cable bundles.) Attempts at communicating with the satellite were unsuccessful until a surprised ground crew received a short transmission on June 2. By mid July, ground station operators had regained full control of the satellite and began to initiate scientific operations with both the telescope array and the VHF experiment. In this paper we will discuss a preliminary analysis of the on-orbit performance of EUV telescopes on ALEXIS.

28593 (LBL–35525) **Hadronic matter and rapidly rotating compact stars.** Weber, F. (Univ. of Munich (Germany). Inst. for Theoretical Physics); Kettner, C.; Glendenning, N.K. Lawrence Berkeley Lab., CA (United States). Mar 1994. 15p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00098. (CONF-9403131–2: International conference on nuclear structure in the late nineties, Hanoi (Viet Nam), 14-18 Mar 1994). Order Number DE94014928. Source: OSTI; NTIS; GPO Dep.

In part one of this paper the authors review the present status of neutron star matter calculations, and introduce a representative collection of realistic nuclear equations of state which are derived for different assumptions about the physical behavior of dense matter (baryon populations, pion condensation, possible transition of baryon matter to quark matter). Part two deals with the theoretical determination of the minimum possible rotational periods of neutron stars, performed in the framework of general relativity, whose knowledge serves to distinguish between pulsars that can be understood as rotating neutron stars and those that cannot. Likely candidates for the latter are hypothetical strange stars. Their properties are discussed in the third part of this contribution.

28594 Velocity damper for electromagnetically levitated materials. Fox, R.J. To Dept. of Energy. 1992. Filed date 24 Jul 1992. U.S. Patent Application 7-918,095. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE94016132. Source: OSTI; NTIS; GPO Dep.

A system for damping oscillatory and spinning motions induced in an electromagnetically levitated material. Two opposed field magnets are located orthogonally to the existing levitation coils for providing a DC quadrupole field (cusp field) around the material. The material used for generating the DC quadrupole field must be nonconducting to avoid eddy-current heating and of low magnetic permeability to avoid distorting the induction fields providing the levitation.

28595 (UCRL-JC–114938) **Sodium laser guide star system at Lawrence Livermore National Laboratory: System description and experimental results.** Avicola, K. (and others); Brase, J.; Morris, J. Lawrence Livermore National Lab., CA (United States). 2 Mar 1994. 18p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-940391–10: Society of Photo-Optical Instrumentation Engineers (SPIE) conference, Kona Beach, HI (United States), 13-18 Mar 1994). Order Number DE94014735. Source: OSTI; NTIS; GPO Dep.

The architecture and major system components of the sodium-layer kw guide star system at LLNL will be described, and experimental results reported. The subsystems include the laser system, the beam delivery system including a pulse stretcher and beam pointing control, the beam director, and the telescope with its adaptive-optics package. The laser system is one developed for the Atomic Vapor Laser Isotope Separation (AVLIS) Program. This laser system can be configured in various ways in support of the AVLIS program objectives, and was made available to the guide star program at intermittent times on a non-interference basis. The first light transmitted into the sky was in July of 1992, at a power level of 1. 1 kW. The laser pulse width is about 32 ns, and the pulse repetition rate was 26 kHz for the 1. 1 kW configuration and 13 kHz for a 400 W configuration. The laser linewidth is tailored to match the sodium D_2 absorption line, and the laser system has active control of beam pointing and wavefront quality. Because of the short pulse length the sodium transition is saturated and the laser power is not efficiently utilized. For this reason a pulse stretcher was developed, and the results of this effort will be reported. The beam is delivered via an evacuated pipe from the laser building to the guide star site, a distance of about 100 meters, and then launched vertically. A beam director provides the means to track the sky in the full AO system, but was not used in the experiments reported here. The return signal is collected by a 1/2 meter telescope with the AO package. This telescope is located 5 meters from the km launch tube. Smaller packages for photometry, wavefront measurement, and spot image and motion analysis have been used. Although the unavailability of the AVLIS laser precluded a full AO system demonstration, data supporting feasibility and providing input to the system design for a Lick Observatory AO system was obtained.

6620 Physics of Elementary Particles and Fields

28596 (DOE/ER/40509–4) **Research accomplishments and future goals in particle physics: Final technical report.** Boston Univ., MA (United States). Dept. of Physics. Jun 1994. 151p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-89ER40509. Order Number DE94015483. Source: OSTI; NTIS; INIS; GPO Dep.

This proposal presents the research accomplishments and ongoing activities of Boston University researchers in high energy physics. Some changes have been made in the structure of the program from the previous arrangement of tasks. Task B, Accelerator Design Physics, is being submitted as a separate proposal for an independent grant; this will be consistent with the nature of the research and the source of funding. Boston University is active in seven principal areas: (1) Task A: Colliding Beams – physics of e^+e^- and $\bar{p}p$ collisions; (2) Task C: MACRO Experiment – search for magnetic monopoles and study of cosmic rays; (3) Task D: Proton Decay – search for nucleon instability and study of neutrino interactions; (4) Tasks E, J, and N: Particle Theory – theoretical high energy particle physics, including two Outstanding Junior Investigator awards; (5) Task F: Muon G-2 – measurement of the anomalous magnetic moment of the muon; (6) Task K: SSCintcal – calorimetry for the GEM Experiment; (7) Task L: Muon Detectors for the GEM Experiment. The body of the proposal is devoted to detailed discussions of each of the tasks. The total budget request for the program appears in a summary chapter that includes a general budget discussion and individual budget requests and explanations for each of the tasks.

28597 (DOE/ER/40684–4) **Research in high energy physics: Progress report, 1 July 1993–30 June 1994.** Rosen, J. (and others); Block, M.; Buchholz, D. Northwestern Univ., Evanston, IL (United States). Jul 1994. 88p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-91ER40684. Order Number DE94015519. Source: OSTI; NTIS; INIS; GPO Dep.

Progress on Task A centered around data analysis. E835 is now approved. It will extend E760 studies, exploring new charmonium states and featuring an upgraded detector system plus operation at 4–6 times higher luminosity. Results are given on E760 analysis. Task B has 10 papers that have either appeared in print, or have been prepared for publication. They break down into four categories; experimental physics, theoretical physics, and computer computational techniques. They are described here along with an exciting new experimental proposal to use DaΦne, the Φ factory that is being constructed at Frascati National Laboratory. Progress for Task C which includes participating in the D0 project at TeV I, and the photoproduction experiment, E687, at TeV II is given. While Northwestern is not participating in the top quark physics group at D0, they have been involved in the data analysis and the discussions that led to the limits on the top quark mass. Task D comprises the shared services for the Northwestern DOE contract. This includes the maintenance and operation of all computers within the HEP group. The projects supported by Task D during the past year are given. Task E progress was to resolve the apparent

conflict between EMC, SMC, and SLAC results on nucleon structure functions and Bjorken sum rules. Task F covered research in hadronic decay of the tau, thermal field theory, plasma effects in astrophysics, and heavy quarkonium. Task G covers E665, a general purpose muon scattering experiment which can detect both the scattered muon and most charged and neutral hadrons produced in the forward region. The Northwest group has collaborated very closely in the past year with the Harvard group on analyses of structure functions and vector meson production in the 1991 data sample.

6621 General Theory of Particles and Fields

Refer also to citation(s) 28612

28598 (BONN-TH-94-04) **On SW-minimal models and N=1 supersymmetric quantum Toda-field theorie.** Mallwitz, S. Bonn Univ. (Germany). Physikalisches Inst. Apr 1994. 26p. (HEP-TH-9405025). Order Number DE94789653. Source: OSTI; NTIS (US Sales Only); INIS.

Integrable N=1 supersymmetric Toda-field theories are determined by a contragredient simple Super-Lie-Algebra (SSLS) with purely fermionic lowering and raising operators. For the SSLA's Osp(3/2) and D(2/1;α) we construct explicitly the higher spin conserved currents and obtain free field representations of the super W-algebras SW(3/2,2) and SW(3/2,3/2,2). In constructing the corresponding series of minimal models using covariant vertex operators, we find a necessary restriction on the Cartan matrix of the SSLA, also for the general case. Within this framework, this restriction claims that there be a minimum of one non-vanishing element on the diagonal of the Cartan matrix. This condition is without parallel in bosonic conformal field theory. As a consequence only two series of SSLA's yield minimal models, namely Osp(2n/2n-1) and Osp(2n/2n+1). Subsequently some general aspects of degenerate representations of SW-algebras, notably the fusion rules, are investigated. As an application we discuss minimal models of SW(3/2, 2), which were constructed with independent methods, in this framework. Covariant formulation is used throughout this paper. (orig.)

28599 (BONN-TH-94-05) **Pathspace decompositions for the Virasoro algebra and its Verma modules.** Kaufmann, R.M. Bonn Univ. (Germany). Physikalisches Inst. May 1994. 19p. Order Number DE94789655. Source: OSTI; NTIS (US Sales Only); INIS.

Starting from a detailed analysis of the structure of pathspaces of the A-fusion graphs and the corresponding irreducible Virasoro algebra quotients V(c,h) for the (2, q odd) models, we introduce the notion of an admissible pathspace representation. The pathspace P_A over the A-Graphs are isomorphic to the pathspaces over Coxeter A-graphs that appear in FB models. We give explicit construction algorithms for admissible representations. From the finitedimensional results of these algorithms we derive a decomposition of V(c,h) into its positive and negative definite subspaces w.r.t. the Shapovalov form and the corresponding signature characters. Finally, we treat the Virasoro operation on the lattice induced by admissible representations adopting a particle point of view. We use this analysis to decompose theVirasoro algebra generators themselves. This decomposition also takes the nonunitarity of the (2,q) models into account. (orig.)

28600 (BONN-TH-94-06) **Two-matrix models and c =1 string theory.** Bonora, L. (International School for Advanced Studies, Trieste (Italy)); Xiong Chuansheng. Bonn Univ. (Germany). Physikalisches Inst. May 1994. 12p. Order Number DE94789654. Source: OSTI; NTIS (US Sales Only); INIS.

We show that the most general two-matrix model with bilinear coupling underlies c = 1 string theory. More precisely we prove that $W_{1+\infty}$ constraints, a subset of the correlation functions and the integrable hierarchy characterizing such two-matrix model, correspond exactly to the $W_{1+\infty}$ constraints, to the discrete tachyon correlation functions and the integrable hierarchy of the c = 1 string theory. (orig.)

28601 (CERN-TH-6841-93) **CP violation in the B meson system and prospects at an asymmetric B meson factory.** Aleksan, R. (CEA Centre d'Etudes de Saclay, 91 - Gif-sur-Yvette (France). Dept. d'Astrophysique, de la Physique des Particules, de la Physique Nucleaire et de l'Instrumentation Associee); Gaidot, A.; Branco, G.C.; Dunietz, I.; Steger, H.; Pich, A. European Organization for Nuclear Research, Geneva (Switzerland). Mar 1993. 33p. (CONF-9210474--: ECFA: Workshop on a B-meson factory, Hamburg (Germany), Oct 1992). Order Number DE94633087. Source: OSTI; NTIS (US Sales Only); INIS.

An overview of the expected phenomenology of CP violation in the B system is presented. The prospects for observing CP-violating signals at an asymmetric B-Factory are analyzed. It is shown how these phenomena can be used to test the unitarity of the Cabibbo-Kobayashi-Maskawa matrix, and to either verify the Standard Model mechanism of CP violation or provide clear evidence for new physics. (authors) 72 refs., 12 figs., 8 tabs.

28602 (DESY-94-028) **Eigenvalues of the Laplacian and of the Hecke operators for PSL(2,Z).** Steil, G. (Hamburg Univ. (Germany). 2. Inst. fuer Theoretische Physik). Deutsches Elektronen-Synchrotron (DESY), Hamburg (Germany). Mar 1994. 27p. Order Number DE94789710. Source: OSTI; NTIS (US Sales Only); INIS.

A new method is described to compute with high accuracy a large number of eigenvalues and eigenfunctions (Maass wave forms) of the Laplacian and of the Hecke operators for the modular group. It relies essentially on the theory of Hecke operators. The results of the computations confirm some important conjectures from number theory, namely Ramanujan-Petersson, Sato-Tate, and the conjecture that the discrete spectrum of the Laplacian be simple. Examples of the numerical data are included as a reference. The algorithm can be generalized to other non-cocompact but cofinite arithmetic groups, like Picard group PSL(2, Z)[i] and Hecke triangle groups $\Gamma(\sqrt{2})$ and $\Gamma(\sqrt{3})$. (orig.)

28603 (DESY-94-046) **Overrelaxation algorithm for coupled gauge-Higgs systems.** Fodor, Z.; Jansen, K. Deutsches Elektronen-Synchrotron (DESY), Hamburg (Germany). Mar 1994. 12p. (HEP-LAT-9403024). Order Number DE94789682. Source: OSTI; NTIS (US Sales Only); INIS.

In this letter we extent the overrelaxation algorithm, known to be very efficient in gauge theories, to coupled gauge-Higgs systems with a particular emphasis on the update of the radial mode of the higgs field. Our numerical tests of the algorithm show that the autocorrelation times can be reduced substantially. (orig.)

28604 (DESY-94-054) **Worldline Green functions for multiloop diagrams.** Schmidt, M.G. (European Organization for Nuclear Research, Geneva (Switzerland). Theoretical Physics Div.); Schubert, C. Deutsches Elektronen-Synchrotron (DESY), Zeuthen (Germany). Inst. fuer Hochenergiephysik. Mar 1994. 14p. (HD-THEP-94-7; HEP-TH-9403158). Order Number DE94789712. Source: OSTI; NTIS (US Sales Only); INIS.

We propose a multiloop generalization of the Bern-Kosower formalism, based on Strassler's approach of evaluating worldline path integrals by worldline Green functions. Those Green functions are explicitly constructed for the basic two-loop graph, and for a loop with an arbitrary number of propagator insertions. For scalar and abelian gauge theories, the resulting integral representations allow to combine whole classes of Feynman diagrams into compact expressions. (orig.)

28605 (SLAC-443) **Letter of intent for the study of CP violation and heavy flavor physics at PEP-II.** BaBar Collaboration. Stanford Linear Accelerator Center, Menlo Park, CA (United States). 18 Jun 1994. 343p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00515. Order Number DE94016583. Source: OSTI; NTIS; INIS; GPO Dep.

This report discusses the following topics on CP violation and heavy flavor physics experiments: Physics at PEP-II; detector overview; PEP-II and the interaction region; vertex detector; main tracking chamber; particle identification; electromagnetic calorimeter; muon and neutral hadron detector; magnet coil and flux return; electronics, trigger, and data acquisition; computing; CP asymmetry simulations; collaboration issues; project organization and management; and budget and schedule.

6622 Specific Theories and Interaction Models; Particle Systematics

Refer also to citation(s) 28604, 28641, 28646, 28655, 28713, 28724

28606 (BNL–60427) **RHIC spin physics.** Bunce, G. RHIC Spin Collaboration. Brookhaven National Lab., Upton, NY (United States). [1994]. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH00016. Order Number DE94016819. Source: OSTI; NTIS; INIS; GPO Dep.

The physics potential of colliding beams of protons, polarized either longitudinally or transversely, at RHIC is remarkable. A luminosity of $L = 2 \times 10^{32}$ cm^{-2} with 70% polarized beams will be available with up to 250 GeV energy in each beam. The proposal to collide polarized protons in RHIC was submitted in August 1992 and approved in October 1993. We have funding for R&D on Siberian Snakes, so that RHIC will be able to accelerate polarized protons early in its program. The expected date of the first heavy ion collisions is 1999. The spin physics program includes measurement of gluon and sea quark polarization in the longitudinally polarized proton, measurement and then application of parity violation in W and Z production, measurement of hard scattering parton-parton asymmetries, and quark polarization or transversity in transversely polarized protons. Single spin asymmetries allow sensitive searches for parity violation (longitudinal polarization), and correlations between quark spin and gluons (transverse). Probes include direct photons (to $P_T = 20$ GeV/c), jets (to $P_T > 50$ GeV/c), Drell-Yan pairs to $M\ell\ell = 9$ GeV, $W^{\pm}$, Z. This program is described in our Particle World paper. Here we will emphasize the new information included in our Update, given to the Brookhaven PAC this September.

28607 (DESY–94-034) **Resummations in hot scalar electrodynamics.** Kraemmer, U. (Deutsches Elektronen-Synchrotron (DESY), Hamburg (Germany)); Rebhan, A.K.; Schulz, H. Deutsches Elektronen-Synchrotron (DESY), Hamburg (Germany). Mar 1994. 55p. (ITP-UH–01/94; HEP-PH–9403301). Order Number DE94789689. Source: OSTI; NTIS (US Sales Only); INIS.

The gauge-boson sector of perturbative scalar electrodynamics is investigated in detail as a testing ground for resummation methods in hot gauge theories. It also serves a simple non-trivial reference system for the non-Abelian gluon plasma. The complete next-to-leading order contributions to the polarization tensor are obtained within the resummation scheme of Braaten and Pisarski. The simpler scheme proposed recently by Arnold and Espinosa is shown to apply to static quantities only, whereas Braaten-Pisarski resummation turns out to need modification for collective phenomena close to the light-cone. Finally, a recently proposed resummation of quasi-particle damping contributions is assessed critically. (orig.)

28608 (DESY–94-036) **Dependence of electroweak parameters on the definition of the top-quark mass.** Kniehl, B.A. (Hamburg Univ. (Germany). 2. Inst. fuer Theoretische Physik). Deutsches Elektronen-Synchrotron (DESY), Hamburg (Germany). Mar 1994. 12p. (HEP-PH–9403386). Order Number DE94789687. Source: OSTI; NTIS (US Sales Only); INIS.

Electroweak parameters depend on the renormalization scheme (and scale) used to define the top-quark mass. We analyze this dependence in $O(\alpha\alpha_s)$ by comparing the evaluations in the on-shell and MS schemes. In the case of the W-boson mass predicted from Δr, we find that the two evaluations differ by not more than 4 MeV when the mass renormalization scale is identified with the top-quark mass. We study also the scale dependence of the MS result. These variations indicate the magnitude of unknown higher-order effects and contribute to the theoretical error of the predictions. (orig.)

28609 (DESY–94-043) **Gauge invariant treatment of the electroweak phase transition.** Buchmueller, W.; Fodor, Z.; Hebecker, A. Deutsches Elektronen-Synchrotron (DESY), Hamburg (Germany). Mar 1994. 14p. Order Number DE94789683. Source: OSTI; NTIS (US Sales Only); INIS.

We evaluate the gauge invariant effective potential for the composite field $\sigma = 2\Phi^1\Phi$ in the SU(2)-Higgs model at finite temperature. Symmetric and broken phases correspond to the domains $\sigma \leq T^2/3$ and $\sigma > T^2/3$, respectively. The effective potential increases very steeply at small values of σ. Predictions for several observables, derived from the ordinary and the gauge invariant effective potential, are compared. Good agreement is found for the critical temperature and the jump in the order parameter. The results for the latent heat differ significantly for large Higgs masses. (orig.)

28610 (DESY–94-045) **Confinement in three dimensions and the electroweak phase transition.** Buchmueller, W.; Fodor, Z. Deutsches Elektronen-Synchrotron (DESY), Hamburg (Germany). Mar 1994. 15p. Order Number DE94789715. Source: OSTI; NTIS (US Sales Only); INIS.

The infrared behaviour of the standard model at finite temperature is determined by the confining phase of the SU(2)-Higgs model in three dimensions. Due to the Landau singularity of the three-dimensional gauge theory the perturbative treatment of the electroweak phase transition breaks down for Higgs masses above a critical mass $m_H{}^c$. Based on a renormalization group improved effective potential we find $m_H{}^c \approx 70$ GeV. The salar self-coupling has a Landau-type singularity also in the abelian U(1)-Higgs model, which leads to a breakdown of perturbation theory in the symmetric phase. (orig.)

28611 (DESY–94-057) **Top-down approach to unified supergravity models.** Hempfling, R. Deutsches Elektronen-Synchrotron (DESY), Hamburg (Germany). Mar 1994. 10p. Order Number DE94789633. Source: OSTI; NTIS (US Sales Only); INIS.

We introduce a new approach for studying unified supergravity models. In this approach all the parameters of the grand unified theory (GUT) are fixed by imposing the corresponding number of low energy observables. This determines the remaining particle spectrum whose dependence on the low energy observables can now be investigated. We also include some SUSY threshold corrections that have previously been neglected. In particular the SUSY threshold corrections to the fermion masses can have a significant impact on the Yukawa coupling unification. (orig.)

28612 (DESY–94-067) **On the renormalization of nonrenormalizable interactions.** Krasnikov, N.V. (Humboldt-Universitaet, Berlin (Germany). Mathematisch-Naturwissenschaftliche Fakultaet). Deutsches Elektronen-Synchrotron (DESY), Hamburg (Germany). Apr 1994. 17p. (HU-Berlin-IEP–94/4). Order Number DE94789635. Source: OSTI; NTIS (US Sales Only); INIS.

We show that supersymmetric QCD with additional nonrenormalizable interaction $\delta L = (h/M) \int d^2\theta\, (XY)^2 + h.c.$ (here X and Y are superquark fields) and QCD with additional four-fermion interaction of the colour quarks can be renormalized. We find that the considered models are equivalent to the fixed-point solutions of the renormalization group equations for the corresponding renormalized analogs of the nonrenormalizable models. (orig.)

28613 (DOE/ER/40561–147) **Hadronization of QCD and effective interactions.** Frank, M.R. Washington Univ., Seattle, WA (United States). Inst. for Nuclear Theory. [1994]. 16p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG06-90ER40561. (CONF-9405132–6: 14. international conference on few body problems in physics, Williamsburg, VA (United States), 26-31 May 1994). Order Number DE94014975. Source: OSTI; NTIS; INIS; GPO Dep.

An introductory treatment of hadronization through functional integral calculus and bifocal Bose fields is given. Emphasis is placed on the utility of this approach for providing a connection between QCD and effective hadronic field theories. The hadronic interactions obtained by this method are nonlocal due to the QCD substructure, yet, in the presence of an electromagnetic field, maintain the electromagnetic gauge invariance manifest at the quark level. A local chiral model which is structurally consistent with chiral perturbation theory is obtained through a derivative expansion of the nonlocalities with determined, finite coefficients. Tree-level calculations of the pion form factor and $\pi - \pi$ scattering, which illustrate the dual constituent-quark-chiral-model nature of this approach, are presented.

28614 (FNAL/C–94/159-E) **Inclusive jet and two-jet differential cross sections at CDF.** CDF Collaboration. Fermi National Accelerator Lab., Batavia, IL (United States). Jun 1994. 13p. Sponsored by USDOE, Washington, DC (United States). DOE Contract

AC02-76CH03000. (CONF-940722–16: 27. international conference on high energy physics, Glasgow (United Kingdom), 21-27 Jul 1994). Order Number DE94015543. Source: OSTI; NTIS; INIS; GPO Dep.

The CDF collaboration collected 19.5 pb^{-1} of data during the 1992–93 collider run at Fermilab. Using these data the inclusive jet cross section is measured in the pseudorapidity (η) range 0.1–0.7. The transverse energy (E_T) range of the jets extends from 15 to 440 GeV. The measured cross section is compared with next-to-leading order ($O(\alpha_s^3)$) QCD predictions for various parton distributions and different choices of renormalization scale. A new limit on Λ_c, a term representing quark substructure, is derived. The two-jet differential cross section is measured by determining the E_T spectrum of central jets ($0.1 < |\eta| < 0.7$) for different η intervals of the second jet which span the range $0.1 < |\eta| < 3.0$. The results are compared with leading order QCD calculations.

28615 (IPNO-TH–91-56) **The Odderon - past, present and future.** Nicolescu, B. (Paris-11 Univ., 91 - Orsay (France). Inst. de Physique Nucleaire). Paris-11 Univ., 91 - Orsay (France). Inst. de Physique Nucleaire. Jul 1991. 21p. (CONF-9105374–: 4. Blois international conference on elastic and diffractive scattering, Elba (Italy), 22-25 May 1991). Order Number DE94633135. Source: OSTI; NTIS (US Sales Only); INIS.

After presenting some short historical considerations concerning the evolution in time of the Odderon approach (from asymptotic theorems to QCD), the experimental finite-energy effects induced by the presence of the Odderon are discussed. The general agreement with the present experimental data is also briefly discussed. The last part of the talk is devoted to the predictions of the Odderon approach at LHC energies. Strong arguments are presented in favour of the adoption of both pp and p-barp options at LHC. (author) 33 refs., 6 figs., 2 tabs.

28616 (IPNO-TH–91-75) **The many facets of QCD at low and medium energies: the role of the nucleus.** Mathiot, J.F. European Collaboration. Paris-11 Univ., 91 - Orsay (France). Inst. de Physique Nucleaire. [1991]. 9p. (CONF-9109453–: 13. European conference on few-body problems in physics, Elba (Italy), 9-14 Sep 1991). Order Number DE94633136. Source: OSTI; NTIS (US Sales Only); INIS.

In the perspective of a European collaboration for a continuous wave electron accelerator in the 15-30 GeV energy range, the first ideas and numerical simulations are presented on the most important and original aspects of this project. The role that the nucleus can play in unravelling the quark dynamics at low and intermediate energies is emphasized. (author) 11 refs., 5 figs.

28617 (IPNO-TH–92-15) **Periodic orbits of the Skyrmion breathing mode: a classical and quantal analysis.** Abada, A. (Paris-11 Univ., 91 - Orsay (France). Div. de Physique Theorique); Vautherin, D. Paris-11 Univ., 91 - Orsay (France). Inst. de Physique Nucleaire. Apr 1992. 25p. Order Number DE94633137. Source: OSTI; NTIS (US Sales Only); INIS.

The periodic classical orbits of the Skyrmion breathing mode is constructed by a perturbation expansion in the amplitude of the vibration. The lowest order construction associated with linear response theory is examined. It is found that the monopole response function exhibits a sharp unbound peak which are identified as the Roper resonance N(1440). A calculation of second order terms provides an evaluation of the anharmonic corrections. In the second part, a collective Bohr-type Hamiltonian is constructed using the knowledge of periodic trajectories. This provides a natural requantization scheme with which the spectrum of monopole excitations of the Skyrmion is calculated. Finally, the results are applied to the calculation of color transparency effects. Anharmonicities are found to reduce significantly the time taken by a small-radius nucleon to regain its normal size. This effect should diminish the importance of the color transparency phenomenon. (authors) 29 refs., 5 figs.

28618 (LAL–93-64) **Precision tests of the standard model: The experimental results.** Lefrancois, J. Paris-11 Univ., 91 - Orsay (France). Lab. de l'Accelerateur Lineaire. Nov 1993. 17p. (CONF-930761–: International Europhysics conference on high-energy physics, Marseille (France), 22-28 Jul 1993). Order Number DE94633127. Source: OSTI; NTIS (US Sales Only); INIS.

Recent measurements of electroweak interaction processes are reviewed. When higher order corrections are included, in the theoretical prediction, an excellent agreement with the experimental results is observed. The fitted magnitudes of the corrections allow a prediction of the top mass to be made: m_{top}=162 GeV_{-17-21}^{+16+18}, the last error corresponds to a 60-1000 GeV range for the Higgs boson mass. The data do not have yet significant sensitivity to the Higgs mass. (author) 32 refs., 22 figs., 3 tabs.

28619 (LBL–35530) **Approximate flavor symmetries.** Rasin, A. Lawrence Berkeley Lab., CA (United States). Apr 1994. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00098. (UCB-PTH–94/09; CONF-940288–1: 2. IFT workshop on Yukawa couplings and the origin of mass, Gainesville, FL (United States), 11-13 Feb 1994). Order Number DE94014917. Source: OSTI; NTIS; INIS; GPO Dep.

We discuss the idea of approximate flavor symmetries. Relations between approximate flavor symmetries and natural flavor conservation and democracy models is explored. Implications for neutrino physics are also discussed.

28620 (LPNHE–92-03) **Experimental tests of QCD: Deep inelastic scattering, e^+e^- annihilation and hard hadron-hadron scattering.** Hansl-Kozanecka, T. (Paris-6 Univ., 75 (France). Lab. de Physique Nucleaire et de Hautes Energies). Paris-6 Univ., 75 (France). Lab. de Physique Nucleaire et de Hautes Energies. [1992]. 100p. Contract DE-AC02-76ER03069. (CONF-910836–: 19. Stanford Linear Accelerator Center (SLAC) summer institute on particle physics, Stanford, CA (United States), 5-16 Aug 1991). Order Number DE94633138. Source: OSTI; NTIS (US Sales Only); INIS.

The phenomenological aspects of Quantum Chromodynamics (QCD) are examined which are relevant for lepton-hadron, electron-positron and hadron-hadron collisions. In deep inelastic scattering the virtual γ or W/Z is used as a probe of the nucleon structure. The strong coupling constant (α_s) measurements via deep inelastic scattering and e^+e^- annihilation are discussed. Parton-parton collisions (e.g., hard hadron-hadron collisions) are examined as the third regime for QCD tests. (K.A.) 122 refs., 84 figs., 4 tabs.

28621 (TRI-PP–89-61) **Electromagnetic properties of nucleons from lattice QCD.** Draper, T. (TRIUMF, Vancouver, BC (Canada)); Woloshyn, R.M.; Liu, Keh-Fei. TRIUMF, Vancouver, BC (Canada). Jul 1989. 13p. Order Number DE94633139. Source: OSTI; NTIS (US Sales Only); INIS.

Submitted to Physics Letters B.

A numerical simulation of QCD on a quenched 24 x 12 x 12 x 24 lattice is used to calculate, at small momentum transfer, the electric and magnetic form factors of a variety of hadrons. (Author) 14 refs., tab., 2 figs.

28622 (TRI-PP–91-43) **Lattice QCD evaluation of baryon magnetic moment sum rules.** Leinweber, D.B. TRIUMF, Vancouver, BC (Canada). May 1991. 10p. Order Number DE94633140. Source: OSTI; NTIS (US Sales Only); INIS.

Magnetic moment combinations and sum rules are evaluated using recent results for the magnetic moments of octet baryons determined in a numerical simulation of quenched QCD. The model-independent and parameter-free results of the lattice calculations remove some of the confusion and contradiction surrounding past magnetic moment sum rule analyses. The lattice results reveal the underlying quark dynamics investigated by magnetic moment sum rules and indicate the origin of magnetic moment quenching for the non-strange quarks in Σ. In contrast to previous sum rule analyses, the magnetic moments of nonstrange quarks in Ξ are seen to be enhanced in the lattice results. In most cases, the spin-dependent dynamics and center-of-mass effects giving rise to baryon dependence of the quark moments are seen to be sufficient to violate the sum rules in agreement with experimental measurements. In turn, the sum rules are used to further examine the results of the lattice simulation. The Sachs sum rule suggests that quark loop contributions not included in present lattice calculations may play a key role in removing the discrepancies between lattice and experimental ratios of magnetic moments. This is supported by other sum rules sensitive to quark loop contributions. A measure of the isospin symmetry breaking in the effective

quark moments due to quark loop contributions is in agreement with model expectations. (Author) 16 refs., 2 figs., 2 tabs.

6623 Specific Interactions, Decays and Processes

Refer also to citation(s) 28600, 28612, 28613

28623 (ANL-HEP-CP-94-40) **A-dependent effects in high P_T reactions.** Fields, T. Argonne National Lab., IL (United States). [1994]. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-940514–9: Intersections of particle and nuclear physics, St. Petersburg, FL (United States), 31 May - 6 jun 1994). Order Number DE94016385. Source: OSTI; NTIS; INIS; GPO Dep.

A brief summary of A-dependent effects which have been observed in various high energy scattering processes from nuclear targets is given. Reactions which are discussed include dijet production, dihadron production, Drell-Yan, deep inelastic muon scattering, and low-P_t hadron production. The data are described in terms of multiple scattering of a fast parton in nuclear matter. Some suggestions for future work are given.

28624 (BONN-IR–93-67) **Strangeness photoproduction with the SAPHIR-detector.** Merkel, H. Bonn Univ. (Germany). Physikalisches Inst.; Bonn Univ. (Germany). Mathematisch-Naturwissenschaftliche Fakultaet. Dec 1993. 74p. (In German). Order Number DE94786360. Source: OSTI; NTIS (US Sales Only); INIS.

At the ELSA facility at Bonn a photon beam with a high duty cycle up to energies of 3.3 GeV is available. In this energy range the large solid angle detector SAPHIR enables us to investigate the strangeness photoproduction starting from threshold. SAPHIR has already achieved results for the reactions $\gamma+p\rightarrow K^+ +\Lambda$ and $\gamma+p\rightarrow K^+ +\Sigma^0$. This work investigates the possibilities to measure the related reactions $\gamma+n\rightarrow K^0+\Lambda$ and $\gamma+n\rightarrow K^0+\Sigma^0$ at a deuteron target and to measure the reaction $\gamma+p\rightarrow K^0+\Sigma^+$ at a proton target. For the first time the Σ^+ polarisation has been measured. With an cross section 10 times smaller compared to the kaon hyperon reactions, the photoproduction of the $\Phi(1020)$ meson can be investigated with the SAPHIR detector too. First reconstructed events are shown. (orig.)

28625 (BONN-IR–93-76) **Dispersion theoretical calculations on the Compton scattering on the nucleon in the first and second resonance.** Coersmeier, T. Bonn Univ. (Germany). Physikalisches Inst.; Bonn Univ. (Germany). Mathematisch-Naturwissenschaftliche Fakultaet. 20 Dec 1993. 98p. (In German). Order Number DE94786361. Source: OSTI; NTIS (US Sales Only); INIS.

This paper is dealing with Compton Scattering off protons and neutrons in the first and second resonance. Imaginary parts of invariant amplitudes for Compton Scattering, which are kinematical-singularity free, are calculated with unitarity relations, considering photoproduction of one and two pions in the s-channel. Further, various inelastic resonances are incoherently added to take other inelastic channels into account. Using dispersion relations under the assumption of s-channel helicity conservation (SCHC), one can calculate the real parts of the invariant amplitudes. The resulting differential cross sections are in good agreement with experimental data for Compton Scattering off protons within the energy range up to 800 MeV. For Compton Scattering off neutrons differential cross sections are computed, too. Using the formalism of density matrices, observables for polarized beams and targets are obtained. Where experimental data exists, quite good agreement with our theoretical results is found. The Drell-Hearn-Gerasimov (DHG) sum rule is examinated in consideration of double pion photoproduction. (orig.)

28626 (BUDKERINP–93-52) **About the ω->3π contact term.** Kuraev, E.A.; Siagadze, Z.K. AN SSSR, Novosibirsk (Russian Federation). Inst. Yadernoj Fiziki. 1993. 26p. (IYaF–93-52.). Order Number DE94633202. Source: OSTI; NTIS (US Sales Only); INIS.

The manifestationsof the ω->3πcontact term and its unitary partners are investigated in the framework of the chiral effective Lagrangian theory with vector mesons. 53 refs.

28627 (CEA-CONF–11691) **Atmospheric neutrinos and neutrino oscillations.** Barloutaud, R. CEA Centre d'Etudes de Saclay, 91 - Gif-sur-Yvette (France). Dept. d'Astrophysique, de la Physique des Particules, de la Physique Nucleaire et de l'Instrumentation Associee. Jan 1993. 12p. (CONF-930187–: 13. Moriond workshop on perspectives in neutrinos, atomic physics, and gravitation, Villars-sur-Ollon (Switzerland), 30 Jan - 6 feb 1993). Order Number DE94633179. Source: OSTI; NTIS (US Sales Only); INIS.

The results on the composition of atmospheric neutrinos interacting in underground detectors and on the rate of atmospheric muon neutrino interactions in the earth surrounding the detectors are reviewed. So far, systematic errors on the neutrino flux and on the electrons and muons neutrino interaction identifications are not yet reliable enough to prove that atmospheric neutrinos oscillate before being detected. (author) 22 refs., 5 figs.

28628 (CEA-CONF–11711) **A review of (e,e'p) data from Saclay.** Le Goff, J.M. (CEA Centre d'Etudes de Saclay, 91 - Gif-sur-Yvette (France). Dept. d'Astrophysique, de la Physique des Particules, de la Physique Nucleaire et de l'Instrumentation Associee); Bernheim, M.; Danel, J.F.; Brussel, M.K.; Capitani, G.P.; Sanctis,CEA Centre d'Etudes de Saclay, 91 - Gif-sur-Yvette (France). Dept. d'Astrophysique, de la Physique des Particules, de la Physique Nucleaire et de l'Instrumentation Associee. 23 Nov 1993. 11p. (CONF-9307145–: Workshop on electron nucleus scattering, Elba (Italy), 5-10 Jul 1993). Order Number DE94633177. Source: OSTI; NTIS (US Sales Only); INIS.

The last (e,e'p) results from the Saclay are reviewed. They include searches for a possible modification of the nucleon form factor when embedded in nuclear medium, this is ^{40}Ca and few-body nuclei; and also studies of two-body properties through the measurement of high proton momenta in ^{3}He and ^{4}He. The new electron facilities might open on these topics. (authors) 19 refs., 5 figs.

28629 (CEA-LNS-Ph–93-14) **P-p analyzing power excitation function between 510 and 725 MeV.** Beurtey, R. (Laboratoire National Saturne, Centre d'Etudes de Saclay, 91 - Gif-sur-Yvette (France)); Arvieux, J.; Boivin, M.; Boyard, J.L.; Durand, J.M.; Combes-Comets, M.P.; Courtat, P.; Gacougnolle, R.; Le Bornec, Y.; Garcon, M. Laboratoire National Saturne, Centre d'Etudes de Saclay, 91 - Gif-sur-Yvette (France). 1993. 5p. (CONF-921131–: 10. international symposium on high-energy spin physics, Nagoya (Japan), 9-14 Nov 1992). Order Number DE94633186. Source: OSTI; NTIS (US Sales Only); INIS.

In an earlier experiment some evidence was observed for narrow dibaryons in the analyzing power excitation function of p-p elastic scattering at $\sqrt{s}$=2160 MeV and 2192 MeV, with width $\Gamma\simeq$13-14 MeV. A different procedure has been carried out at the SATURNE synchrotron, in order to obtain a very high accuracy of the analyzing power for a large number of energies between 510 and 725 MeV. The results show no evidence for any structure with width $\approx$5 to 20 MeV. The reasons at the difference between the two experiments are discussed. (K.A.) 2 refs., 3 figs.

28630 (DESY–94-020) **Quantum effects on Higgs-boson production and decay due to Majorana neutrinos.** Kniehl, B.A. (Hamburg Univ. (Germany). 2. Inst. fuer Theoretische Physik); Pilaftsis, A. Deutsches Elektronen-Synchrotron (DESY), Hamburg (Germany). Feb 1994. 28p. (RAL–94-021; HEP-PH–9402314). Order Number DE94789711. Source: OSTI; NTIS (US Sales Only); INIS.

We analyze the phenomenological implications for new electroweak physics in the Higgs sector in the framework of $SU(2)_L$ x $U(1)_Y$ theories that naturally predict heavy Majorana neutrinos. We calculate the one-loop Majorana-neutrino contributions to the decay rates of the Higgs boson into pairs of quarks and intermediate bosons and to its production cross section via bremsstrahlung in e^+e^- collisions. It turns out that these are extremely small in three-generation models. On the other hand, the sizeable quantum corrections generated by a conventional fourth generation with a Dirac neutrino may be screened considerably in the presence of a Majorana degree of freedom. (orig.)

28631 (DESY–94-035) **Production and decay of the standard model Higgs boson at LEP200.** Gross, E. (Weizmann Inst.

of Science, Rehovoth (Israel). Dept. of Particle Physics); Wolf, G.; Kniehl, B.A. Deutsches Elektronen-Synchrotron (DESY), Hamburg (Germany). Mar 1994. 29p. (WIS–94/15/MAR-PH). Order Number DE94789688. Source: OSTI; NTIS (US Sales Only); INIS.

We collect and update theoretical predictions for the production rate and decay branching fractions of the Standard Model Higgs boson that will be relevant for the Higgs search at LEP200. We make full use of the present knowledge of radiative corrections. We estimate the systematics arising from theoretical and experimental uncertainties. (orig.)

28632 (DESY–94-041) **Some aspects of pion physics in the Nambu- and Jona-Lasinio model and chiral Lagrangians.** Tegen, R. Deutsches Elektronen-Synchrotron (DESY), Hamburg (Germany). Mar 1994. 53p. Order Number DE94789685. Source: OSTI; NTIS (US Sales Only); INIS.

I discuss here to what extent the original two-flavour NJL model (which has a minimal number of adjustable parameters) reproduces pion observables. In particular, the sensitivity of the recently calculated electromagnetic mass shift to these NJL parameters is pointed out and a new way to fix them is suggested. A new set of $O(1/N_c)$ diagrams, which are the first meson loop corrections to the RPA, is presented and its effect on the pionic Goldstone mode, its electromagnetic form factor, weak decay constant, and on the constituent quark mass m is discusseed. The relation of these NJL model results to some other chiral Lagrangians is pointed out, where ever possible. The here presented higher order diagrams indicate how one could systematically generate the next-order diagrams. It is, however, questionable whether the simplistic but mathematically manageable contact interaction of the NJL model should be maintained also in these higher order diagrams. (orig.)

28633 (DESY–94-042) **Inclusive jet production at HERA: Next-to-leading order QCD corrections to the resolved and direct photon contribution.** Boedeker, D. (Minnesota Univ., Minneapolis, MN (United States). Theoretical Physics Inst.); Kramer, G.; Salesch, S.G. Deutsches Elektronen-Synchrotron (DESY), Hamburg (Germany). Mar 1994. 17p. Sponsored by Bundesministerium fuer Forschung und Technologie, Bonn (Germany). Foerderkennzeichen BMFT 056HH93P. Order Number DE94789684. Source: OSTI; NTIS (US Sales Only); INIS.

We have calculated high transverse energy single-jet inclusive cross sections for γp-collisions at next-to-leading order superimposing direct and resolved photoproduction. The dependence on the scale and the scheme for the factorization of the photon structure is studied quantitatively. The accuracy of the predictions due to variations of all scales is investigated. (orig.)

28634 (DESY–94-044) **$O(\alpha^2L^2)$ radiative corrections to deep inelastic ep scattering for different kinematical variables.** Bluemlein, J. Deutsches Elektronen-Synchrotron (DESY), Zeuthen (Germany). Inst. fuer Hochenergiephysik. Mar 1994. 16p. Order Number DE94789664. Source: OSTI; NTIS (US Sales Only); INIS.

The QED radiative corrections are calculated in the leading log approximation up to $O(\alpha^2)$ for different definitions of the kinematical variables using jet measurement, the 'mixed' variables, the double angle method, and a measurement based on θ_e and y_{JB}. Higher order contributions due to exponentiation of soft radiation are included. (orig.)

28635 (DESY–94-047) **Comparison of cone and event-decomposition jet algorithms in resolved photon reactions.** Valkarova, A. (Karlova Univ., Prague (Czech Republic). Nuclear Center); Knies, G. Deutsches Elektronen-Synchrotron (DESY), Hamburg (Germany). Mar 1994. 22p. Order Number DE94789714. Source: OSTI; NTIS (US Sales Only); INIS.

The method of jet construction by event decomposition is tested and compared to the jet construction method by cone forming. Its potential for recovering parton kinematics from large p_t and from photon remnant jets is investigated in detail. Effects from the response of a realistic detector (H1) are included. The hard scattering parton kinematics can be reconstructed with comparable quality as in the cone method. The reconstruction of the photon remnant jet mass by event decomposition provides clear advantages in comparison with the cone method for separating direct and resolved photon reactions. (orig.)

28636 (DESY–94-051) **Standard-model predictions for W-pair production in electron-positron collisions.** Beenakker, W. (Deutsches Elektronen-Synchrotron (DESY), Hamburg (Germany). Gruppe Theorie); Denner, A. Deutsches Elektronen-Synchrotron (DESY), Hamburg (Germany). Mar 1994. 82p. Order Number DE94789638. Source: OSTI; NTIS (US Sales Only); INIS.

We review the status of the theoretical predictions for W-pair production in e^+e^- collisions within the electroweak standard model (SM). We first consider for on-shell W-bosons the lowest-order cross-section within the SM, the general effects of anomalous couplings, the radiative corrections within the SM, and approximations for them. Then we discuss the inclusion of finite-width effects in lowest order and the existing results for radiative corrections to off-shell W-pair production, and we outline the general strategy to calculate radiative corrections within the pole scheme. We summarize the theoretical predictions for the total and partial W-boson widths including radiative corrections and discuss the quality of an improved Born approximation. Finally we provide a general discussion of the structure-function method to calculate large logarithmic higher-order corrections associated with collinear photon radiation. (orig.)

28637 (DESY–94-056) **Scaling behaviour of jet shapes in p anti p and ep collisions.** Kramer, G. (Hamburg Univ. (Germany). 2. Inst. fuer Theoretische Physik); Salesch, S.G. Deutsches Elektronen-Synchrotron (DESY), Hamburg (Germany). Mar 1994. 16p. Sponsored by Bundesministerium fuer Forschung und Technologie, Bonn (Germany). Foerderkennzeichen BMFT 056HH93P; Contract EEC CHRX-CT93-0357. Order Number DE94789632. Source: OSTI; NTIS (US Sales Only); INIS.

We have calculated jet shapes in resolved γp and p anti p collisions in perturbation theory at order α_s^3 for the hard parton-parton processes. We compared the jet shapes for different c.m. energies $\sqrt{S}$ and between the two processes for fixed $x_T = 2E_T/\sqrt{S}$ and fixed cone parameters.We found a simple scaling behaviour of the jet shape which allows its comparison for different reactions and c.m. energies. (orig.)

28638 (DOE/ET/53088–665) **Electron-neutrino phase separation instability.** Lai, C.; Tajima, T. Texas Univ., Austin, TX (United States). Inst. for Fusion Studies. Jul 1994. 15p. Sponsored by USDOE, Washington, DC (United States);National Science Foundation, Washington, DC (United States). DOE Contract FG05-80ET53088. (IFSR–665). Order Number DE94016859. Source: OSTI; NTIS; INIS; GPO Dep.

Deduced from Weinberg-Salam electroweak theory, a Boltzmann equation and subsequent fluid equations are derived for the primordial electron-positron-neutrino-photon plasma. A collective instability that separates the phases of electrons (and positrons) and neutrinos (and anti-neutrinos) is discussed. Cosmological implications are mentioned.

28639 (FNAL/C–94/138-E) **Measurement of the B_s meson lifetime at CDF.** CDF Collaboration. Fermi National Accelerator Lab., Batavia, IL (United States). Jun 1994. 16p. Sponsored by USDOE, Washington, DC (United States);National Science Foundation, Washington, DC (United States);Alexander von Humboldt-Stiftung, Bonn (Germany);Istituto Nazionale di Fisica Nucleare, Rome (Italy);Ministry of Education, Science and Culture (DOE Contract AC02-76CH03000. (CONF-940722–15: 27. international conference on high energy physics, Glasgow (United Kingdom), 21-27 Jul 1994). Order Number DE94015381. Source: OSTI; NTIS; INIS; GPO Dep.

Proton-antiproton collision data corresponding to a total integrated luminosity of $\sim$ 21 pb^{-1} were collected with the CDF detector at the Fermilab Tevatron collider during 1992–1993. The lifetime of the B_s meson is measured using events from the semileptonic decay $B_s \rightarrow \ell^+\nu D_s^-X$ and from the exclusive decay $B_s \rightarrow J/\psi\phi$. For the semileptonic decay channel, 76 $\ell^+D_s^-$ signal events are selected where the D_s is identified via the decay $D_s^- \rightarrow \phi\pi^-$, $\phi \rightarrow K^+K^-$. From this sample the B_s meson lifetime is determined to be $\tau_s = 1.42_{-0.23}^{+0.27}$ (stat.)$_{-0.11}^{+0.11}$ (syst.) ps. In the $J/\psi\phi$ channel, 11 events are used and the lifetime is found to be $\tau_s = 1.74_{-0.60}^{+0.90}$ (stat.)$_{-0.07}^{+0.07}$ (syst.) ps.

28640 (FNAL/C–94/141-E) **Measurement of the B meson differential cross-sections in $p\bar{p}$ collisions at $\sqrt{s}$ = 1.8 TeV using the exclusive decays $B^{\pm} \rightarrow J/\psi K^{\pm}$ and $B^0 \rightarrow J/\psi K^{*0}$.** CDF Collaboration. Fermi National Accelerator Lab., Batavia, IL (United States). Jun 1994. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH03000. (CONF-940722–14: 27. international conference on high energy physics, Glasgow (United Kingdom), 21-27 Jul 1994). Order Number DE94015185. Source: OSTI; NTIS; INIS; GPO Dep.

This paper presents the first measurement of the differential $B^{\pm}$ and B^0 cross-sections, $d\sigma/dp_T$, in $p\bar{p}$ collisions at $\sqrt{s}$ = 1.8 TeV. The data sample used represents an integrated luminosity of 19.3 $\pm$ 0.8 pb^{-1} accumulated by the Collider Detector at Fermilab (CDF). The cross-sections are measured over the p_T range 6–15 GeV/c in the central pseudorapidity region $|\eta| < 1$ by fully reconstructing the B meson decays $B^{\pm} \rightarrow J/\psi K^{\pm}$ and $B^0 \rightarrow J/\psi K^{*0}$, where the J/ψ is required to decay to two muons, and the K^{*0} is required to decay to $K^{\pm}\pi^{\mp}$. The measured absolute normalization and shape of the cross-section as a function of p_T are compared to the theoretical QCD prediction calculated at next-to-leading order.

28641 (FNAL/C–94/146-E) **Tests of structure functions using leptons at CDF: W asymmetry and Drell-Yan production.** Fermi National Accelerator Lab., Batavia, IL (United States). Jun 1994. 17p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH03000. (CONF-940722–17: 27. international conference on high energy physics, Glasgow (United Kingdom), 21-27 Jul 1994). Order Number DE94015727. Source: OSTI; NTIS; INIS; GPO Dep.

The charge asymmetry as a function of lepton rapidity, $A(y_l)$, has been measured at $\sqrt{s}$ = 1.8 TeV for $|y_l| < 1.8$, using the W decays to electrons and muons recorded by CDF during the 1992-1993 run of the Tevatron Collider. The luminosity used, approximately 20 pb^{-1}, and detector improvements resulted in a seven fold increase in statistics relative to the 1988-1989 data. The increased statistics in the 1992-1993 data allow for discrimination between sets of modern parton distribution functions. The results of this analysis demonstrate the value of collider data in the measurement of the proton's structure. In addition, the Drell-Yan cross section has been measured using $\sim$ 4 pb^{-1} of dielectron and $\sim$ 2.5 pb^{-1} of dimuon data taken during the 1988-1989 run. These measurements probe the quark distributions to $x < 0.01$ at high Q^2 where nonperturbative effects are minimal. Studies of Drell-Yan production in the $\sim$ 20 pb^{-1} data from the 1992-1993 run are currently underway.

28642 (FNAL/C–94/151-E) **Evidence for color coherence in jet events.** CDF Collaboration. Fermi National Accelerator Lab., Batavia, IL (United States). Jun 1994. 36p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH03000. (CONF-940722–18: 27. international conference on high energy physics, Glasgow (United Kingdom), 21-27 Jul 1994). Order Number DE94016334. Source: OSTI; NTIS; INIS; GPO Dep.

Color coherence effects in $p\bar{p}$ collisions are observed and studied with CDF, the Collider Detector at the Fermilab Tevatron collider. We demonstrate these effects by measuring spatial correlations between soft and leading jets in multi jet events. Variables sensitive to interference are identified by comparing the data to the predictions of various shower Monte Carlos that are substantially different with respect to the implementation of coherence.

28643 (FNAL/C–94/152-E) **Multi-jet analysis for the top search at the Fermilab collider.** CDF Collaboration. Fermi National Accelerator Lab., Batavia, IL (United States). Jun 1994. 10p. Sponsored by USDOE, Washington, DC (United States);National Science Foundation, Washington, DC (United States);Istituto Nazionale di Fisica Nucleare, Rome (Italy);Ministry of Education, Science and Culture (Japan);Natural Sciences and Engineering Research DOE Contract AC02-76CH03000. (CONF-940722–8: 27. international conference on high energy physics, Glasgow (United Kingdom), 21-27 Jul 1994). Order Number DE94014988. Source: OSTI; NTIS; INIS; GPO Dep.

The search for a top signal in the multi-jet sample is presented. The $t\bar{t}$ decays considered here are the Standard Model ones in which both W's decay into a quark pair, thus generating a nominal 6-jets topology. Despite the enormous initial background rate, a reasonable signal-to-background ratio has been achieved once the SVX detector is used for b-tagging the events. Application of the method to the existing data set is presented, along with expectations for future runs.

28644 (FNAL/C–94/154-E) **Production properties of Z bosons with jets in 1.8 TeV $p\bar{p}$ collisions.** CDF Collaboration. Fermi National Accelerator Lab., Batavia, IL (United States). May 1994. 14p. Sponsored by USDOE, Washington, DC (United States);Istituto Nazionale di Fisica Nucleare, Rome (Italy);Ministry of Education, Science and Culture (Japan);Natural Sciences and Engineering Research Council of Canada, Ottawa, ON (Canada);Sloan (Alfred P.) Fo DOE Contract AC02-76CH03000. (CONF-940722–13: 27. international conference on high energy physics, Glasgow (United Kingdom), 21-27 Jul 1994). Order Number DE94015184. Source: OSTI; NTIS; INIS; GPO Dep.

The authors have measured the production of Z bosons from 1.8 TeV $p\bar{p}$ collisions using 19.3 pb^{-1} of integrated luminosity collected by the CDF during the 1992–93 Tevatron run. The production properties of the hadronic jets associated with the Z bosons are compared to leading-order QCD calculations using the VECBOS Monte Carlo program. For a subsample of events, B jets are identified using CDF's silicon tracker, and the rates compared to those expected from events with generic QCD jets.

28645 (FNAL/C–94/155-E) **Search for $W' \rightarrow e\nu$ in $p\bar{p}$ collisions at $\sqrt{s}$ = 1,800 GeV.** CDF Collaboration. Fermi National Accelerator Lab., Batavia, IL (United States). Jun 1994. 13p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH03000. (CONF-940722–12: 27. international conference on high energy physics, Glasgow (United Kingdom), 21-27 Jul 1994). Order Number DE94015188. Source: OSTI; NTIS; INIS; GPO Dep.

The authors have searched for new, heavy charged gauge bosons, W'. The signature searched for is $W' \rightarrow e\nu$, where it is assumed that the neutrino in this decay is stable and non-interacting, thus leaving a momentum imbalance in the detector. They have examined the highest transverse mass electron + missing momentum events from $p\bar{p}$ collisions at $\sqrt{s}$ = 1.8 TeV for new Jacobian peaks above the W mass. The data used in the search represent 19.7 pb^{-1} collected by CDF at the Fermilab Tevatron Collider. The authors establish limits on the W' cross section times branching ratio; assuming standard couplings of the W' to fermions, they establish the limit $M_{W'} > 634$ GeV/c^2 (95% C.L.).

28646 (FNAL/C–94/158-E) **Electroweak boson pair production at CDF.** CDF Collaboration. Fermi National Accelerator Lab., Batavia, IL (United States). Jun 1994. 21p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH03000. (CONF-940722–11: 27. international conference on high energy physics, Glasgow (United Kingdom), 21-27 Jul 1994). Order Number DE94015183. Source: OSTI; NTIS; INIS; GPO Dep.

Preliminary results from CDF on $W + \gamma$, $Z + \gamma$ and W^+W^-, WZ, ZZ boson pair production in $\sqrt{s}$ = 1.8 TeV $\bar{p}$-p collisions from the 1992–93 collider run are presented. Measurements of the production cross section x decay branching ratios $\sigma * B(W + \gamma)$ and $\sigma * B(Z + \gamma)$ have been obtained. The cross section ratios $R(W\gamma/W)$, $R(Z\gamma/Z)$, $R(W\gamma/Z\gamma)$ and R(W/Z) are discussed. The authors extract direct limits on CP-conserving and CP-violating $WW\gamma$, WWZ, $ZZ\gamma$ and $Z\gamma\gamma$ anomalous couplings. In the static limit, the direct experimental limits on $WW\gamma$ and $ZZ\gamma$ anomalous couplings are related to bounds on the higher-order static (transition) EM moments of the W (Z) bosons. Expectations from the on-going and future Tevatron collider runs are discussed.

28647 (FNAL/C–94/180-E) **Jet studies at CDF/D0 collaborations.** Bartalini, P. Fermi National Accelerator Lab., Batavia, IL (United States). Jun 1994. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH03000. (CONF-940327–7: 29. Moriond meeting on quantum chromodynamics and high energy hadronic interactions, Les Arcs (France), 12-26 Mar 1994). Order Number DE94015537. Source: OSTI; NTIS; INIS; GPO Dep.

Both CDF and D0 collaborations measure inclusive jet cross section, energy flow and observe color coherence effects in $p\bar{p}$ collisions at $\sqrt{s}$ = 1800 GeV. The results on new compositeness limit

using inclusive jet cross section and energy flow within a jet are described. Data are in good agreement with next to leading order QCD calculations. Color coherence effects are demonstrated by measuring spatial correlations between soft and leading jets in multi jet events.

28648 (FNAL/C–94/185-E) **Production asymmetries in x_F and P_t^2 for $D^{\pm}$ mesons.** E791 Collaboration. Fermi National Accelerator Lab., Batavia, IL (United States). Jul 1994. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH03000. Order Number DE94015546. Source: OSTI; NTIS; INIS; GPO Dep.

Non-zero asymmetries have been reported in x_f distributions of leading and non-leading charmed mesons produced from hadronic beams. Production models have also been proposed that would explain these asymmetries and make predictions on how these asymmetries will depend on P_t^2. The authors present differences in leading and non-leading D charged meson production as a doubly differential function of both P_t^2 and x_f. This information is from the preliminary analysis of 1/3 of the data from Fermilab experiment E791. It was taken during the 1991–2 fixed target run using a 500 GeV/c π^- beam incident on a segmented target.

28649 (FZR–34(prepr.)) **Dielectron production in proton-proton an proton-deuteron collisions at 1-5 GeV.** Titov, A.I. (National Taiwan Normal Univ., Taipei (Taiwan, Province of China). Inst. of Physics); Kaempfer, B.; Bratkovskaya, E.L. Forschungszentrum Rossendorf e.V. (FZR), Rossendorf bei Dresden (Germany). Mar 1994. 22p. Order Number DE94789720. Source: OSTI; NTIS (US Sales Only); INIS.

Estimates of elementary cross sections for dielectron production in pN and pd reactions are presented. We use throughout the vector dominance model for all hadron-hadron-photon vertices. Dynamical suppression mechanisms (e.g., mass dependent Δ production rate, and the correct energy dependence of the two-body T matrix) bring the elementary rate near to experimental data and previous estimates which do not use vector meson dominance. The Δ, η Dalitz decays and bremsstrahlung appear as dominant sources of dielectrons. Bremsstrahlung is dealt within an improved soft photon approximation which also applies for the pp collisions. Relying on a realistic deuteron wave function we also estimate the energy dependence of the ratio of dielectron yields in pd to pp reactions and find qualitative agreement with new experimental results. (orig.)

28650 (IPNO-DRE–91-36) **Heavy meson production at Saturne: the role of baryon resonances.** Le Bornec, Y. (Paris-11 Univ., 91 - Orsay (France). Inst. de Physique Nucleaire); Wilkin, C. Paris-11 Univ., 91 - Orsay (France). Inst. de Physique Nucleaire. [1991]. 24p. (CONF-9109127–: Workshop on baryon spectroscopy and the structure of the nucleon, Saclay (France), 23-25 Sep 1991). Order Number DE94633187. Source: OSTI; NTIS (US Sales Only); INIS.

A selection of experiments performed at SATURNE which demonstrate the role played by N* resonances is presented. Nucleon-nucleon and proton-deuteron reactions are discussed and analyzed. Recent theoretical interpretations are also briefly described. (R.P.) 27 refs., 20 figs.

28651 (IPNO-TH–91-53) **New threshold model for high-energy elastic scattering.** Kang, K. (Brown Univ., Providence, RI (United States). Dept. of Physics); White, A.R. Paris-11 Univ., 91 - Orsay (France). Inst. de Physique Nucleaire. Jul 1991. 10p. (CONF-9105374–: 4. Blois international conference on elastic and diffractive scattering, Elba (Italy), 22-25 May 1991). Order Number DE94633188. Source: OSTI; NTIS (US Sales Only); INIS.

There are two interesting experimental results from the hadron colliders that, might perhaps entail the beginning of new physics beyond that expected from the standard picture of hadron interactions. They are the large UA4 result for the real part of the elastic pp-bar forward scattering amplitude and the more recent result of the 'low' pp-bar total cross-section at the Fermilab Tevatron energy reported by E710. A theoretical model is presented that can explain all scattering data for the total cross-section and the real part including those of UA4 and E710. It is shown that a new threshold model with a threshold close to but below the UA4 energy is compatible with all forward elastic scattering data. Possible origin of the threshold and related new physics are also discussed (K.A.) 2 figs.

28652 (IPNO-TH–91-97) **N-barN interaction theoretical models.** Loiseau, B. (Paris-11 Univ., 91 - Orsay (France). Div. de Physique Theorique). Paris-11 Univ., 91 - Orsay (France). Inst. de Physique Nucleaire. Dec 1991. 17p. (CONF-920126–: 13. international conference on few body problems in physics, Adelaide (Australia), 5-11 Jan 1992). Order Number DE94633189. Source: OSTI; NTIS (US Sales Only); INIS.

Submitted to Nucl. Phys., A (NL).

In the framework of antinucleon-nucleon interaction theoretical models, our present understanding on the N-barN interaction is discussed, either from quark- or/and meson- and baryon-degrees of freedom, by considering the N-barN annihilation into mesons and the N-barN elastic and charge-exchange scattering. (author) 52 refs., 11 figs., 2 tabs.

28653 (KEK-PROC–93-22) **Proceedings of the 2nd workshop on TRISTAN physics at high luminosities.** Sagawa, H.; Tsukamoto, T.; Watanabe, I.; Yamada, Y. (eds.). National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan). Mar 1994. 451p. (CONF-9311226–: 2. workshop on TRISTAN physics at high luminosities, Tsukuba (Japan), 24-26 Nov 1993). Order Number DE94785274. Source: OSTI; NTIS; INIS.

This publication is the collection of the papers presented at the title meeting. The 34 of the presented papers are indexed individually. (J.P.N.).

28654 (LAL–93-66) **Results from the H1 experiment at HERA.** Jaffre, M. H1 Collaboration. Paris-11 Univ., 91 - Orsay (France). Lab. de l'Accelerateur Lineaire. Nov 1993. 17p. (CONF-9309396–: Hadron structure '93 conference, Banska Stiavnica (Slovakia), Sep 1993). Order Number DE94633180. Source: OSTI; NTIS (US Sales Only); INIS.

A review of the main results in photoproduction and deep inelastic physics obtained by H1 during its first year of running is presented. The total photoproduction cross section has been measured. Jets have been observed as the result of hard scattering processes. The inclusive jet cross section has been compared to QCD model predictions. In deep inelastic scattering, the measurement of the proton structure function $F_2(x,Q^2)$ for x values down to 10^{-4} and $Q^2>10$ GeV^2 is presented. Various studies of the hadronic final state were performed including particle energy flow, transverse momentum distributions and jet rates. (author) 36 refs., 12 figs.

28655 (LPNHE–93-07) **Hard QED radiation at HERA.** Krasny, M.W. Paris-6 Univ., 75 (France). Lab. de Physique Nucleaire et de Hautes Energies. 1993. 15p. (CONF-9303228–: Workshop on HERA: the new frontier for QCD, Durham (United Kingdom), 21-26 Mar 1993). Order Number DE94633181. Source: OSTI; NTIS (US Sales Only); INIS.

The deep inelastic electron-proton collisions at HERA are frequently associated with emissions of hard photons. A large fraction of these events can be identified either by the direct detection of radiative photons, or, indirectly, by a mismatch between the event kinematics determined from the scattered electron energy and its angle and that determined from the hadronic flow associated with a deep inelastic scattering. This unique feature of HERA experiments provides an experimental check on the size of radiative corrections. The emission of photons collinear with the incident electrons leads to a reduction of the effective beam energy. This effect can be used to measure the longitudinal structure function. (author) 16 refs., 6 figs.

28656 (NIKHEF-H–94-09) **Experimental momentum spectra of identified hadrons in jets and the predictions from LPHD + MLLA.** Bruemmer, N.C. Nationaal Inst. voor Kernfysica en Hoge-Energiefysica (NIKHEF), Amsterdam (Netherlands). Sectie H. May 1994. 8p. Order Number DE94789643. Source: OSTI; NTIS; INIS.

Experimental data on the shape of hadronic momentum spectra are compared with theoretical predictions in the context of calculations in the Modified Leading Log Approximation (MLLA), under the assumption of Local Parton Hadron Duality (LPHD). Considered

are experimental measurements at e^+e^--colliders of ξ_p^*, the position of the maximum in the distribution of $\xi_p=\log(1/x_p)$, where $x_p=p/p_{beam}$. The parameter ξ_p^* is determined for various hadrons at various centre of mass energies. It is interesting to look at the dependence of ξ_p^* on the hadron type. This is used to study the influence of the hadron tye on the cut-off scale Q_0 in the parton shower development. The dependence of ξ_p^* on the centre of mass energy is seen to be described adequately by perturbation theory. The approach is made quantitative by extracting a value of $\alpha_s(m_Z)$ fro an overall fit to the scaling behviour of ξ_p^*. (orig.)

28657 (PCCF-RI–91-09) **Tagging b quark events in ALEPH with neural networks.** Proriol, J. (Clermont-Ferrand-2 Univ., 63 - Aubiere (France). Lab. de Physique Corpusculaire); Jousset, J.; Guicheney, C.; Falvard, A.; Henrard, P.; Pallin, D.; Perret, P.; Brandl, B. Clermont-Ferrand-2 Univ., 63 - Aubiere (France). Lab. de Physique Corpusculaire. [1991]. 27p. (CONF-9106464–: Workshop on neural networks from biology to high energy physics, Marciana Marina (Italy), 5-14 Jun 1991). Order Number DE94633190. Source: OSTI; NTIS (US Sales Only); INIS.

Comparison of different methods to tag b quark events are presented: multilayered perceptron (MLP), Learning Vector Quantization (LVQ), discriminant analysis, combination of any two of the above methods. The sample events come from the ALEPH Monte Carlo and data, from the 1990 ALEPH runs. (authors) 12 refs., 16 figs., 5 tabs.

28658 (TRI-PP–89-49) **Integral cross sections for π^+p scattering between 52 and 126 MeV.** Friedman, E. (Hebrew Univ., Jerusalem (Israel). Racah Inst. of Physics); Goldring, A.; Wagner, G.J.; Altman, A.; Johnson, R.R.; Meirav, O.; Hanna, M.; Jennings, B.K. TRIUMF, Vancouver, BC (Canada). Jun 1989. 10p. Order Number DE94633191. Source: OSTI; NTIS (US Sales Only); INIS.

Submitted to Physics Letters B.

Integral cross-sections for the elastic scattering of π^+ on p from 20 degrees and 30 degrees to 180 degrees were measured at seven energies between 52 and 126 MeV. These integrals are found to be in good agreement with predictions made with currently accepted phase-shifts. (Author) 15 refs., tab., 2 figs.

28659 (TRI-PP–89-55) **Measurement of np→dπ^0 cross sections very near threshold.** Hutcheon, D.A. (TRIUMF, Vancouver, BC (Canada)); Abegg, R.; Greeniaus, L.G.; Miller, C.A.; Korkmaz, E.; Moss, G.A.; Edwards, G.W.R.; Mack, D.; Olsen, W.C.; Ye, Y.; Davison, N.E.; van Heerden, I.J. TRIUMF, Vancouver, BC (Canada). Jun 1989. 12p. Order Number DE94633192. Source: OSTI; NTIS (US Sales Only); INIS.

We have measured np→dπ^0 cross sections at ten beam energies within 16 MeV of threshold. Total cross sections followed closely the relationship $\sigma_{tot}(np\rightarrow d\pi^0) = (1/2)[(184\pm5)\eta^3]\mu b$, where η is the c.m. pion momentum in units of $m_\pi c$. The differential cross sections are anisotropic at only 1 MeV (c.m.) above threshold. These results are predicted by Faddeev model calculations and by a perturbative model. Our cross sections are in fair agreement with previous $\pi^+d\rightarrow pp$ data. (Author) 12 refs., tab., 4 figs.

28660 (TRI-PP–89-56) **Np elastic scattering analyzing power characteristics at intermediate energies.** Abegg, R. (TRIUMF, Vancouver, BC (Canada)); Davis, C.A.; Delheij, P.P.J.; Green, P.W.; Greeniaus, L.G.; Healey, D.C.; Miller, C.A.; Rodning, N.L.; Wait, G.D.; Ahmad, M.; Cairns, E.B.; Coombes, G.H.; Lapointe, C.; McDonald, W.J.; Moss, G.A.; Roy, G.; SoukupTRIUMF, Vancouver, BC (Canada). Jun 1989. 12p. Order Number DE94633193. Source: OSTI; NTIS (US Sales Only); INIS.

Recent measurements of charge symmetry breaking in the np system at 477 MeV, and of A_{conn} for np elastic scattering at 220, 325 and 425 MeV also yield accurate analyzing power data. These data allow the energy dependence of the analyzing power zero-crossing angle and the slope of the analyzing power at the zero-crossing to be determined. The incident neutron energies span a region where the zero-crossing angle is strongly energy dependent (E_n < 250 MeV) to where it is almost independent of energy (E_n > 350 MeV). The results are compared to current phase shift analysis predictions, recently published LAMPF data, and the predictions of the Bonn and Paris potentials. (Author) 13 refs., 2 tabs., 2 figs.

28661 (TRI-PP–89-57) **The spin correlation parameter and analyzing power in n-p elastic scattering at intermediate energies.** Abegg, R. (TRIUMF, Vancouver, BC (Canada)); Davis, C.A.; Delheij, P.P.J.; Greeniaus, L.G.; Healey, D.C.; Miller, C.A.; Wait, G.D.; Ahmad, M.; Green, P.W.; Lapointe, C.; McDonald, W.J.; Moss, G.A.; Rodning, N.L.; Roy, G.; Ye, Y.; Bandyopadhyay, D.; BirchallTRIUMF, Vancouver, BC (Canada). Jun 1989. 25p. Order Number DE94633194. Source: OSTI; NTIS (US Sales Only); INIS.

Submitted to Physical Review C.

In order to improve existing I=0 phase shift solutions, the spin correlation parameter, A_{NN}, and the analyzing powers, A_{0N} and A_{N0}, have been measured in n-p elastic scattering over an angular range of 50 degrees -150 degrees (c.m.) at three neutron energies, 220, 325 and 425 MeV to an absolute accuracy of ±0.03. The data have a profound effect on various phase parameters, particularly the $^1P_1$, $^3D_2$ and ϵ_1 phase parameters which in some cases change by almost a degree. With exception of the highest energy, the data support the predictions of the latest version of the Bonn potential. Also the analyzing power data (A_{0N} and A_{N0}) measured at 477 MeV in a different experiment over a limited angular range (60 degrees - 80 degrees (c.m.)) are reported here. (Author) 30 refs., 10 figs., 5 tabs.

28662 (TRI-PP–90-11) **Low energy pion-nucleon scattering in a relativistic meson exchange model.** Pearce, B.C.; Jennings, B.K. TRIUMF, Vancouver, BC (Canada). Mar 1990. 8p. Order Number DE94633195. Source: OSTI; NTIS (US Sales Only); INIS.

We develop a relativistic meson exchange approach to the pion-nucleon interaction using a three dimensional relativistic two body propagator. This approach is able to describe low energy scattering up to 400 MeV above threshold, while preserving the soft pion theorems. (Author) 18 refs., 3 tabs., fig.

28663 (TRI-PP–90-12) **Charged pion photoproduction on the nucleon near threshold.** Nozawa, S. TRIUMF, Vancouver, BC (Canada). Mar 1990. 14p. Order Number DE94633182. Source: OSTI; NTIS (US Sales Only); INIS.

Submitted to Phys. Rev. C.

Charged pion photoproduction on the nucleon is investigated in the threshold energy region. The energy dependence of the $E_{0+}(\pi^\pm)$ multipole amplitude is examined in detail. It is shown that the energy dependence of $E_{0+}(\pi^\pm)$ and the p-wave multipole contribution are important for the experimental determination of the $E_{0+}(\pi^\pm)$ amplitude in the threshold region. It is also shown that the large cancellations in the final state interaction contribution reported in earlier papers is rather model-independent. (Author) 15 refs., tab., 7 figs.

28664 (TRI-PP–90-14) **CP violation in η, $K_L \rightarrow \mu$antiμ^- decays and electric dipole moments of electron and muon.** Geng, C.Q.; Ng, J.N. TRIUMF, Vancouver, BC (Canada). Mar 1990. 25p. Order Number DE94633204. Source: OSTI; NTIS (US Sales Only); INIS.

Submitted to Physical Review D.

The CP-violating longitudinal polarization asymmetry P_L of the outgoing muon in $\eta \rightarrow \mu_\mu^-$ decays and the electric dipole moments of electron and muon (d_l, l = e,μ) are studied in various extensions of the standard CP violation model. The possibility of having large P_L in both decays and d_l is explored.

28665 (TRI-PP–91-10) **Measurements of NN → dπ^0 very near threshold. I.: The np → dπ^0 cross section.** Hutcheon, D.A. (TRIUMF, Vancouver, BC (Canada)); Abegg, R.; Greeniaus, L.G.; Miller, C.A.; Korkmaz, E.; Moss, G.A.; Edwards, G.W.R.; Mack, D.; Olsen, W.C.; Ye, Y.; Davison, N.E.; van Heerden, I.J. TRIUMF, Vancouver, BC (Canada). Apr 1991. 26p. Order Number DE94633197. Source: OSTI; NTIS (US Sales Only); INIS.

Submitted to Nuclear Physics A.

We have measured cross sections for the reaction np → dπ^0 at beam energies very near the pion production threshold. The yield near threshold is 23% lower than the previously accepted value based on π^+d → pp data. P-wave pion production was observed at energies as low as 1.5 MeV (c.m.) above threshold. There was on evidence of narrow πNN resonances in the energy range surveyed - 275 to 291 MeV, corresponding to pion c.m. momenta between 2 and 43 MeV/c. (Author) 29 refs., tab., 13 figs.

28666 (TRI-PP–91-11) **Measurements on NN → dπ very near threshold. II: The pp → dπ⁺ analyzing power.** Korkmaz, E. (Alberta Univ., Edmonton, AB (Canada). Nuclear Research Centre); Li, J.; Hutcheon, D.A.; Abegg, R.; Elliott, J.B.; Greeniaus, L.G.; Mack, D.J.; Miller, C.A.; Rodning, N.L. TRIUMF, Vancouver, BC (Canada). Apr 1991. 22p. Order Number DE94633198. Source: OSTI; NTIS (US Sales Only); INIS.

We have measured analyzing powers for the reaction pp → dπ⁺ at beam energies 3 and 7 MeV above pion production threshold. With the use of Watson's Theorem to fix phases and effective range estimates of pion d-wave strength, we have been able to determine the NN → dπ s-wave amplitude and the two p-wave amplitudes at these energies. The results are compared to the Faddeev model predictions of Blankleider. (Author) 11 refs., 2 tabs., 11 figs.

28667 (TRI-PP–91-44) **Calibration of the polarization of a frozen spin target.** Abegg, R. (TRIUMF, Vancouver, BC (Canada)); Davis, C.A.; Delheij, P.P.J.; Greeniaus, L.G.; Healey, D.C.; Miller, C.A.; Wait, G.D.; Ahmad, M.; Green, P.W.; Lapointe, C.; McDonald, N.L.; Moss, G.A.; Rodning, N.L.; Roy, G.; Ye, Y.; Bandyopadhyay, D.; Birchall(TRIUMF, Vancouver, BC (Canada). Apr 1991. 17p. Order Number DE94633175. Source: OSTI; NTIS (US Sales Only); INIS.

Submitted to Nuclear Instruments and Methods.

A recent experiment, measuring the spin correlation parameter A_{nn} in neutron-proton elastic scattering to a precision of ± 0.03 at several energies in the range 200 to 500 MeV, required the polarization of the proton frozen-spin target used in the experiment to be known to an accuracy of ± 2%. The calibration of the polarization of the frozen-spin target was accomplished through an experiment interleaved with the A_{nn} experiment. An unpolarized proton beam, of an intensity comparable to the intensity of the neutron beam in the A_{nn} experiment, was scattered at 24 degrees lab. from the frozen-spin target at energies of 469 and 501 MeV. From the measured left-right asymmetries and knowledge of the proton-proton analyzing powers, A_y (24 deg, 469 MeV) = 0.4087 ± 0.0060 and A_y (24 deg, 501 MeV) 0.4204 ± 0.0059, the target polarizations could be deduced. The weighted average of the ratios of the target polarization deduced in the scattering experiment and obtained from nuclear magnetic resonance measurements was found to be Pt(scattering)/Pt(NMR) 0.964 ± 0.008(stat) ± 0.021(sys) ± 0.014(sys) at 468 MeV and 0.950 ± 0.005(stat) ±0.022(sys) ± 0.013(sys) at 501 MeV. By dividing the target cell holding the butanol beads, as illuminated by the incident proton beam, in three parts (top, middle, and bottom) a determination of the average polarization for each of the three parts was made. A definite decrease of the polarization going from top to bottom of the target cell was found. (Author) 15 refs., fig., 2 tabs.

6624 Properties of Specific Particles and Resonances

Refer also to citation(s) 28626, 28640, 28716

28668 (DESY–94-061) **Can the supersymmetric μparameter be generated dynamically without a light singlet?.** Hempfling, R. Deutsches Elektronen-Synchrotron (DESY), Hamburg (Germany). Apr 1994. 7p. (HEP-PH–9404257). Order Number DE94789639. Source: OSTI; NTIS (US Sales Only); INIS.

It is generally assumed that the dynamical generation of the Higgs mass parameter of the superpotential, μ, implies the existence of a light singlet at or below the supersymmetry breaking scale, M_{SUSY}. We present a counter-example in which the singlet field can receive an arbitrarily heavy mass (e.g., of the order of the Planck scale, $M_P \approx 10^{19}$ GeV). In this example, a non-zero value of μ is generated through soft supersymmetry breaking parameters and is thus naturally of the order of M_{SUSY}. (orig.)

28669 (FNAL/C–94/153-E) **The measurement of the W boson mass from CDF.** CDF Collaboration. Fermi National Accelerator Lab., Batavia, IL (United States). Jun 1994. 12p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH03000. (CONF-940722–19: 27. international conference on high energy physics, Glasgow (United Kingdom), 21-27 Jul 1994). Order Number DE94016335. Source: OSTI; NTIS; INIS; GPO Dep.

Recent results from LEP experiments have substantially improved the knowledge of the Z boson. However, hadron colliders remain the only source of direct measurements of the W boson. There have been measurements of the W boson mass from the UA2 and CDF collaborations. The W mass continues to be a subject of great interest in testing the Standard Model. Here, the authors have made a preliminary determination of the W boson mass $M_W = 80.38 \pm 0.23$ GeV/c^2 from a combined analysis of W → eν and W → μν in $\bar{p}p$ collisions at $\sqrt{s}$ = 1.8 TeV. The electron data alone yields $M_W = 80.47 \pm 0.15$(stat.) ± 0.25(syst.) GeV/c^2, while the muon data gives $M_W = 80.29 \pm 0.20$(stat.) ± 0.24(syst.) GeV/c^2.

28670 (INS-J–177) **Search for scalar and vector leptoquarks in electron-proton collisions at $\sqrt{S}$ = 300 GeV.** Hazumi, Masashi (Tokyo Univ. (Japan)). Tokyo Univ., Tanashi (Japan). Inst. for Nuclear Study. Dec 1993. 175p. Order Number DE94785267. Source: OSTI; NTIS; INIS.

A search for a resonant state coupled to an electron-quark pair has been performed using collisions of the electron beam of 26.7 GeV and the proton beam of 820 GeV. With the integrated luminosity of 26.6 ± 1.6 nb^{-1}, scalar and vector leptoquarks have been searched for in the neutral current and charged current samples. The selected events agreed well with the prediction of the Standard Model, and no evidence has been found for production of leptoquarks decaying into e^- + jet or ν + jet. Limits on the coupling strength of scalar (vector) leptoquarks to electron and quark have been determined for masses from 50 (40) GeV to 225 GeV. A limit on the leptoquark mass has been also obtained at the 95% confidence level assuming that either left-handed or right-handed coupling exists to the electron-quark pair with electroweak strength. The mass limit depends on the cross section determined by the choice of quantum numbers. Leptoquarks are ruled out for masses below 216 GeV with the largest cross section and below 105 GeV with the smallest cross section. (author) 102 refs.

28671 (IPNO-TH–91-92) **On the groundstate energy of n anyons.** Khare, A. (Institute of Physics, Bhubaneswar (India)); Ouvry, S.; McCabe, J. Paris-11 Univ., 91 - Orsay (France). Inst. de Physique Nucleaire. Dec 1991. 16p. Order Number DE94633231. Source: OSTI; NTIS (US Sales Only); INIS.

The groundstate energy of n anyons experiencing both a constant magnetic field and a harmonic central potential is analyzed. The dependence of the groundstate on the direction of the magnetic field is emphasized. For example, in the 3-anyon case, when the magnetic field is parallel to the anyon flux tubes the groundstate has one or two crossovers, and when the magnetic field is antiparallel to the flux tubes, one crossover at most, depending on the relative strength of the magnetic field and the harmonic potential. (K.A.) 14 refs., 2 figs.

28672 (IPNO-TH–91-96) **Perturbative equation of state for a gas of anyons: second order.** Dasnieres de Veigy, A. (Paris-11 Univ., 91 - Orsay (France). Div. de Physique Theorique); Ouvry, S. Paris-11 Univ., 91 - Orsay (France). Inst. de Physique Nucleaire. Dec 1991. 16p. Order Number DE94633232. Source: OSTI; NTIS (US Sales Only); INIS.

The grand canonical partition function of a gas of anyons near Bose and Fermi statistics is calculated at second order in the anyon coupling constant. The order α^2 correction to the equation of state of an anyon gas is considered, starting either from Bose or Fermi statistics. The first order perturbation calculation, in the light of the second quantized formalism is reconsidered. As an illustration the statistical dependence of the third virial coefficient is displayed. (author) 15 refs., 2 figs., 2 tabs.

28673 (IPNO-TH–92-22) **Meson modes in nuclear matter with the Nambu-Jona-Lasinio model.** Jaminon, M. (Liege Univ. (Belgium). Inst. de Physique); Stassart, P.; Mendez- Galain, R. Paris-11 Univ., 91 - Orsay (France). Inst. de Physique Nucleaire. [1992]. 38p. (CONF-9112183–: 2. International workshop on nuclear theory and related topics, Hanoi (Viet Nam), 2-9 Dec 1991). Order Number DE94633221. Source: OSTI; NTIS (US Sales Only); INIS.

The Nambu - Jona-Lasinio (NJL) Lagrangian, including J=0, 1 mesons is developed in order to calculate the masses and the

modes of the mesons π, σ, ρ and a_1 in a dense baryonic matter. Two, different nuclear matter effects are separated: the first one corresponds to the modification of the inner structure of the mesons due to the variations of the vacuum properties. The second one studies the propagation in the dense medium of this 'new' meson interacting with other particles. This latter effect can be entirely computed in terms of traditional hadronic physics. The meson masses entering in the Lagrangians should be modified in order to take the first effect into account. (R.P.) 15 refs., 9 figs., 6 tabs.

28674 (LAL–93-60) **LEP measurements on production, mass, lifetime of beauty particles.** Wormser, G. Paris-11 Univ., 91 - Orsay (France). Lab. de l'Accelerateur Lineaire. Oct 1993. 13p. (CONF-9306134–: Conference on hadron, Como (Italy), 21-25 Jun 1993). Order Number DE94633216. Source: OSTI; NTIS (US Sales Only); INIS.

Present knowledge about the individual properties of the different beauty particles is discussed using the results of the LEP experiments. Individual lifetimes for B_d^0 and B^+ are found to be equal within 10% whilst a 15% precision is reached for B_s^0 and Λ_b. The Λ_b lifetime is found to be smaller than τ_{B^+} with a 2.7 σ significance. The production rate of each of these particles is measured at the 20% level. Preliminary evidence for Ξ_b production has been reported. Finally, the B_s^0 meson mass has been measured to be 5373 $\pm$ 4 MeV/c^2. (author) 24 refs., 9 figs., 5 tabs.

28675 (LA-UR–94-2327) **Modeling mesons with relativistic wave equations.** Sommerer, A.J. (Iowa Univ., Iowa City, IA (United States). Dept. of Physics and Astronomy); El-Hady, A.A.; Spence, J.R.; Vary, J.P.; Benesh, C. Los Alamos National Lab., NM (United States). [1994]. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-9405132–7: 14. international conference on few body problems in physics, Williamsburg, VA (United States), 26-31 May 1994). Order Number DE94016057. Source: OSTI; NTIS; INIS; GPO Dep.

We use two relativistic quasi-potential equations to fit meson spectra. A global fit of 45 mesons is achieved with an rams deviation from experiment of 43 MeV, and we compare meson two-photon decay widths calculated using the model wave functions with experimentally measured widths. We give an example calculation of in-medium (high temperature) effects that may be incorporated in the models.

28676 (LBL–35568) **Searches for massive neutrino emission in ^{14}C beta and ^{55}Fe electron-capture decays.** Wietfeldt, F.E. (California Univ., Berkeley, CA (United States). Dept. of Physics). Lawrence Berkeley Lab., CA (United States). May 1994. 153p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00098. Order Number DE94016863. Source: OSTI; NTIS; INIS; GPO Dep.

In 1985 Simpson reported evidence for the emission of a 17 keV mass neutrino in a small fraction of tritium beta decays. An experimental controversy ensued in which a number of both positive and negative results were reported. The beta spectrum of ^{14}C was collected in a unique ^{14}C-doped planar germanium detector and a distortion was observed that initially confirmed Simpson's result. Further tests linked this distortion to a splitting of the collected charge between the central detector and the surrounding guard ring in a fraction of the events. A second ^{14}C measurement showed no evidence for emission of a 17 keV mass neutrino. In a related experiment, a high statistics electron-capture internal-bremsstrahlung photon spectrum of ^{55}Fe was collected with a coaxial germanium detector. A local search for departures from a smooth shape near the endpoint was performed, using a second-derivative technique. An upper limit of 0.65% (95% C.L.) for the mixing Of a neutrino in the mass range 5–25 keV was established. The upper limit on the mixing of a 17 keV mass neutrino was 0.14% (95% C.L.).

28677 (LPNHE–92-01) **A detailed simulation of F_2 measurability at HERA.** Bernardi, G.; Hildesheim, W. Paris-6 Univ., 75 (France). Lab. de Physique Nucleaire et de Hautes Energies. [1992]. 21p. Order Number DE94633217. Source: OSTI; NTIS (US Sales Only); INIS.

A study on the measurement of the F_2 proton structure function is presented, based on a realistic Monte Carlo of the H1 detector. The influence of systematic errors and detector acceptance on the values of x, y and Q^2 was studied in four independent reconstruction methods, based on: the electron only, the hadrons only, or 2 separate combinations of electronic and hadronic information. In particular, results from the combined measurement of y with the hadronic system, and Q^2 from the electron indicate that the evolution of F_2 will be measurable at low Q^2 ($\approx$50 GeV^2) on two orders of magnitude in x. (authors) 10 refs., 10 figs.

28678 (TRI-PP–90-19) **Electromagnetic form factors of spin 3/2 baryons.** Nozawa, S.; Leinweber, D.B. TRIUMF, Vancouver, BC (Canada). Apr 1990. 13p. Order Number DE94633218. Source: OSTI; NTIS (US Sales Only); INIS.

Electromagnetic multipole form factors for spin 3/2 baryons are presented in a fully relativistic calculation from a general hadron current matrix element. The matrix element is expressed in terms of the multipole form factors which are in turn illustrated in terms of the general current matrix element parameters. Finally, the multipole form factors are isolated and expressed in terms of the general current matrix elements. The latter results are particularly useful in lattice QCD calculations. (Author) 6 refs.

6631 Nuclear Structure

Refer also to citation(s) 28627, 28709, 28715

28679 (ANL/PHY/CP–82290) **Octupole shapes in heavy nuclei.** Ahmad, I. Argonne National Lab., IL (United States). [1994]. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-940740–1: International conference on selected topics in nuclear structure, Dubna (Russian Federation), 5-9 Jul 1994). Order Number DE94016337. Source: OSTI; NTIS; INIS; GPO Dep.

Theoretical calculations and measurements show the presence of strong octupole correlations in thecyround states and low-lying states of odd-mass and odd-odd nuclei in the RaPa region. Evidence for octupole correlations is provided by the observation of parity doublets and reductions in M1 matrix elements, decoupling parameters, and Coriolis matrix elements Involving high-j states. Enhancement of E1 transition rates has also been observed for some of the octupole deformed nuclei. The most convincing argument for octupole deformation is provided by the similarities of the reduced alpha decay rates to the two members of parity doublets.

28680 (ANL/PHY/CP–83297) **Search for octupole deformation in neutron rich Xe isotopes.** Bentaleb, M. (Universite Louis Pasteur, Strasbourg (France). Centre de Recherches Nucleaires); Schulz, N.; Lubkiewicz, E. Argonne National Lab., IL (United States). [1994]. 6p. Sponsored by USDOE, Washington, DC (United States);Science and Engineering Research Council, Swindon (United Kingdom). DOE Contract W-31109-ENG-38 ; FG02-91ER40609. Grant GR.H71161. (CONF-9406212–1: Antibes conference on nuclear shapes and nuclear structure at low excitation energies, Antibes (France), 20-25 Jun 1994). Order Number DE94015093. Source: OSTI; NTIS; INIS; GPO Dep.

A search for octupole deformation in neutron rich Xe isotopes has been conducted through gamma-ray spectroscopy of primary fragments produced in the spontaneous fission of ^{248}Cm. The spectrometer consisted of the Eurogam array and a set of 5 LEPS detectors. Level schemes were constructed for Xe isotopes with masses ranging from 138 to 144. Except for ^{139}Xe, none of them exhibit an alternating parity quasimolecular band, α feature usually encountered in octupole deformed nuclei. Substantial evidence for reflection asymmetric shape in the intrinsic system of the nucleus exists for the light actinide nuclei.

28681 (ANL/PHY/CP–83538) **Testing the IBM plus broken pairs model at high spin: An experimental viewpoint.** Lister, C.J. (Argonne National Lab., IL (United States)); Chowdhury, P.; Vretenar, D. Argonne National Lab., IL (United States); Yale Univ., New Haven, CT (United States); Massachusetts Univ., Lowell, MA (United States). [1994]. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38 ; FG02-91ER40609 ; FG02-94ER40848. (CONF-940697–2: International conference on perspectives for the interacting Boson model on the occasion of its 20th anniversary, Padua (Italy), 13-17 Jun 1994). Order Number DE94016351. Source: OSTI; NTIS; INIS; GPO Dep.

Extensive measurements and calculations have been made on neutron deficient A = 80–90 nuclei. The measurements focused on extracting electromagnetic matrix elements between states of angular momentum J > 12h, which provided stringent tests of the IBM plus broken pairs model in the four quasi-particle regime. Starting from a detailed analysis of ^{86}Zr, the model was extended to both isotones and isotopes in the region. The model is especially powerful for interpreting transitional nuclei where the competition between vibrational and single particle degrees of freedom determine the structure of states and their decays. It appears entirely appropriate for analysis of the new features revealed by the "third generation" gamma arrays.

28682 (CEA-CONF–11692) **Hartree-Fock and Hartree-Fock-Bogolyubov calculations of superdeformed bands.** Flocard, H. (Paris-11 Univ., 91 - Orsay (France). Inst. de Physique Nucleaire); Gall, B.; Chen, B.Q.; Dobaczewski, J.; Heenen, P.H.; Weiss, M.S.; Bonche, P. CEA Centre d'Etudes de Saclay, 91 - Gif-sur-Yvette (France). Service de Physique Theorique. 7 Dec 1992. 14p. (CONF-9210249–: 1992 international symposium on rapidly rotating nuclei, Tokyo (Japan), 26-30 Oct 1992). Order Number DE94633249. Source: OSTI; NTIS (US Sales Only); INIS.

Some original features are presented of the cranked mean-field derived with the Skyrme effective interaction. Results obtained with this method which concerns the questions raised by the existence of identical SD bands in the ^{192}Hg region are discussed. In order to include pairing effects, one must replace cranked Hartree-Fock (HF) equations by cranked Hartree-Fock-Bogolyubov (HFB) equations. It is shown that a mean-field calculation can generate identical rotational bands in nuclei differing by one or two nucleons in either the Dy or the Hg regions. (K.A.) 27 refs., 5 figs., 1 tab.

28683 (CEA-CONF–11699) **The Hartree-Fock+BCS and generator coordinate methods.** Heenen, P.H. (Universite Libre de Bruxelles (Belgium)); Skalski, J.; Bonche, P.; Tajima, N.; Dobaczewski, J.; Flocard, H. CEA Centre d'Etudes de Saclay, 91 - Gif-sur-Yvette (France). Service de Physique Theorique. 8 Dec 1992. 21p. (CONF-9203281–: Nuclear structure models workshop, Oak Ridge, TN (United States), 16-25 Mar 1992). Order Number DE94633250. Source: OSTI; NTIS (US Sales Only); INIS.

A new method to solve the Hartree-Fock+BCS equations with minimal symmetry requirements is described. It is shown that this method is very accurate, with reasonable computing time. The method can be generalized to study the nuclear dynamics within the generator coordinate method, and some applications examples are presented. (authors) 35 refs., 9 figs.

28684 (CEA-CONF–11714) **The spin-dependent structure function of the deuteron.** Platchkov, S. SMC Collaboration. CEA Centre d'Etudes de Saclay, 91 - Gif-sur-Yvette (France). Dept. d'Astrophysique, de la Physique des Particules, de la Physique Nucleaire et de l'Instrumentation Associee. 23 Nov 1993. 9p. (CONF-9308164–: 14. European conference on few-body problems in physics, Amsterdam (Netherlands), 22-27 Aug 1993). Order Number DE94633238. Source: OSTI; NTIS (US Sales Only); INIS.

The SMC collaboration at CERN has recently measured the spin-dependent structure function $g_1^d(x)$ of the deuteron. The first moment Γ_1^d of $g_1^d(x)$ is found to be two standard deviations below the prediction of the Ellis-Jaffe sum-rule. The inferred quark contribution to the proton spin is $\Delta\Sigma = 0.06\pm0.20\pm0.15$. When combined with the result of EMC for the proton Γ_1^p, the difference $\Gamma_1^p-\Gamma_1^n$ $0.20\pm0.05\pm0.04$ is deduced, in good agreement with the fundamental Bjorken sum rule. Comparison with other experiments shows that in the region of x where the measurements overlap, the SMC deuteron data agree with the combination of EMC data for the proton and the recent E142 data for the neutron. (author) 24 refs., 7 figs.

28685 (CEA-DAPNIA-SPhN–93-46) **Separation of electromagnetic response functions of few-body nuclei in (e,e'p) reactions.** Marchand, C. CEA Centre d'Etudes de Saclay, 91 - Gif-sur-Yvette (France). Dept. d'Astrophysique, de la Physique des Particules, de la Physique Nucleaire et de l'Instrumentation Associee. Oct 1993. 10p. (CONF-9308164–: 14. European conference on few-body problems in physics, Amsterdam (Netherlands), 22-27 Aug 1993). Order Number DE94633251. Source: OSTI; NTIS (US Sales Only); INIS.

The latest results in electro-induced reactions on few-body nuclei are discussed, especially the recent experimental determinations of the cross sections for the reactions ^{2}H(e,e'p)n and ^{3}He(e,e'p)^{2}H, for which three out of four electromagnetic structure functions have been separated. These new precise data allow a thorough study of the reaction mechanism of the (e,e'p) reaction at momentum transfers up to one GeV. The data are compared to theoretical descriptions of the (e,e'p) cross sections which include final state interactions, meson exchange currents and relativistic effects by consistently solving the scattering problem. The relevance of FSI at low q and the importance of a relativistic treatment of the current operator at high q and the longitudinal-transverse interference structure function are discussed. (author) 19 refs., 3 figs.

28686 (GANIL-P–93-29) **Unstable three dimensional nuclear matter in stochastic mean field approach.** Colonna, M. (Grand Accelerateur National d'Ions Lourds (GANIL), 14 - Caen (France)); Chomaz, Ph. Grand Accelerateur National d'Ions Lourds (GANIL), 14 - Caen (France). 1993. 22p. Order Number DE94633239. Source: OSTI; NTIS (US Sales Only); INIS.

Submitted to Physical Review, C (Nuclear Physics) (US).

A semi-classical stochastic mean-field approach is discussed. In the case of unstable infinite nuclear matter, the characteristic time of the exponential growing of fluctuations and the diffusion coefficients associated to the unstable modes are calculated in the framework of the Boltzmann-Langevin theory. In order to make realistic 3D calculations feasible, the complicated Boltzmann-Langevin theory is suggested to be replaced by a simpler stochastic meanfield approach corresponding to a standard Boltzmann evolution, complemented by a simple noise chosen to reproduce the dynamics of the most unstable modes. Finally, it is explained how to approximately implement this method by simply tuning the noise associated to the use of a finite number of test particles in Boltzmann-like calculations. (authors) 17 refs., 5 figs.

28687 (GANIL-P–93-30) **Nuclear physics at GANIL: Trends.** Harar, S. Grand Accelerateur National d'Ions Lourds (GANIL), 14 - Caen (France). 1993. 12p. (CONF-9310319–: International school on paradigms in nuclear physics, Erice (Italy), 10-15 Oct 1993). Order Number DE94633252. Source: OSTI; NTIS (US Sales Only); INIS.

An overview is given of recent nuclear physics experiments performed at GANIL and some trends for the next future are pointed out. The stress is mainly on studies of nuclei under extreme conditions, and on progresses achieved with radioactive beams. Thermal and mechanical properties of nuclear matter, and nuclear multifragmentation in heavy ion reactions are investigated. The GANIL Plus project of upgrading the beams from the GANIL facility is outlined briefly. (author) 21 refs., 11 figs.

28688 (GANIL-P–93-32) **Gamow-Teller strength functions of superfluid odd nuclei and neutrino capture reactions.** Borzov, I.N. (Institute of Physics and Engineering, Obninsk (Russian Federation)); Trykov, E.L.; Fayans, S.A. Grand Accelerateur National d'Ions Lourds (GANIL), 14 - Caen (France). 1993. 30p. Order Number DE94633240. Source: OSTI; NTIS (US Sales Only); INIS.

The charge-exchange excitations of superfluid odd-A nuclei are studied within the framework of the self-consistent finite Fermi-system theory. The pairing blocking effect due to the odd quasiparticle, the effective NN-interactions both in the particle-hole (ph) and particle-particle (pp) channel, and also the ph-continuum are taken into account. Gamow-Teller strength functions of ^{71}Ga, ^{115}In and ^{19}F nuclei are calculated and compared with those extracted from experimental spectra of (p,n) reactions. The total capture cross sections of the reactor electron antineutrinos are calculated (assuming complete μ_e-bar→μ_e conversion), as well as the solar neutrino capture rates for the ^{71}Ga and ^{115}In+^{19}F detectors. Uncertainties regarding nuclear structure information involved in these calculations are discussed. (authors) 55 refs., 4 figs., 3 tabs.

28689 (GANIL-P–94-01) **Multiple phonon excitation in nuclei.** Chomaz, Ph. (Grand Accelerateur National d'Ions Lourds (GANIL), 14 - Caen (France)); Frascaria, N. Grand Accelerateur National d'Ions Lourds (GANIL), 14 - Caen (France). 1994. 180p.

(IPNO-DRE–94-01.). Order Number DE94633241. Source: OSTI; NTIS (US Sales Only); INIS.

Submitted to Physics Reports (NL).

The studies of multiphonon excitations in nuclei are reviewed both from the theoretical and experimental points of view. The presence of giant resonances in nuclei is described in the framework of macroscopic and microscopic models and the relative merits of different probes to excite such states are illustrated. The existence of giant resonances built on excited states is stressed. An exhaustive description of the theoretical estimates of the properties of the multiphonon states is presented. The theory predicts that such multiple collective excitations should closely follow a harmonic pattern. Recent experimental results on the double giant dipole resonance using the $(\pi^+\pi^-)$ double charge exchange reaction are shown. The status of the search for isoscalar multiphonon excitations by means of the strong nuclear potential produced by heavy ions is presented. Conclusions are drawn and new prospects are discussed. (authors) 293 refs., 67 figs., 8 tabs.

28690 (GANIL-P–94-02) **Microscopic description of low-lying one- and two-phonon states and application to ^{96}Zr.** Fayans, S.A. (Grand Accelerateur National d'Ions Lourds (GANIL), 14 - Caen (France)); Platonov, A.P.; Graw, G.; Hofer, D. Grand Accelerateur National d'Ions Lourds (GANIL), 14 - Caen (France). 1994. 52p. Order Number DE94633242. Source: OSTI; NTIS (US Sales Only); INIS.

A self-consistent approach to finite Fermi systems is expanded for the description of two-phonon states in non-magic nuclei with weak anharmonicity. It is based on a density-functional approach, the quasi-particle random-phase approximation (QRPA) and the Green's function method. This approach is applied to the low-lying excitations in ^{96}Zr. The transition density of the two-phonon state in ^{96}Zr is calculated. It is shown that interplay of one-phonon and two-phonon configurations may lead to the origin of two 6^+ states with strongly different excitation probabilities. Mixing coefficients and energy splitting of these states are estimated microscopically. The transition probabilities of the one-phonon states 3_1^- and 6^+ and the mixing coefficients of the one- and two-phonon 6^+ states are used as input for DWBA and Coupled-Channels calculations for inelastic scattering of 22 MeV polarized deuterons. Calculated cross sections for the 6^+ states are compared with experimental data. (authors) 26 refs., 11 figs., 1 tab.

28691 (GSI–94-23(prepr.)) **The Gamow-Teller decay of ^{105}Sn to three-particle states in ^{105}In.** Pfuetzner, M. (Warsaw Univ. (Poland). Inst. of Experimental Physics); Plochocki, A.; Rykaczewski, K.; Szerypo, J.; Zylicz, J.; Keller, H. Gesellschaft fuer Schwerionenforschung mbH, Darmstadt (Germany). Apr 1994. 35p. Order Number DE94789758. Source: OSTI; NTIS (US Sales Only); INIS.

The EC/β^+ decay of ^{105}Sn was reinvestigated by using ^{58}Ni (5 MeV/u) + ^{50}Cr reactions, chemically selective on-line mass separation and γ-ray spectroscopy. The half-life of ^{105}Sn has been determined as 34 $\pm$ 1 s. Out of 104 γ transitions ascribed to the ^{105}Sn decay, 89 have been placed in the decay scheme including 52 excited states of ^{105}In. From the EC/β^+ feeding of individual states, the distribution of the Gamow-Teller (GT) strength has been derived. It is shown that the main part of the GT strength is associated with the feeding of ^{105}In levels having excitation energies above 3 MeV. This observation can be interpreted as a sign of dominant feeding of three-quasiparticle states in ^{105}In, which correspond to the $\pi(g_{9/2})^{-1}$ $\nu d_{5/2}$ shell-model configuration spread over many levels. The sum of the GT strength deduced from the present gamma ray data of $B_\Sigma(GT)$=1.46 povides a lower limit to the total GT strength. Many weak transitions, mainly from high energy levels, may not have been detected in this study and therefore part of the strength may be missed. An indirect support for this conclusion has been obtained from the analysis of the indium KX-rays intensity. This analysis indicates about 50% contribution of the electron-capture to the beta decay of ^{105}Sn, which is interpreted as a sign of a predominant feeding of the high-energy ^{105}In states with $B_\Sigma(GT)\geq 3$. The observed GT distribution and strength will be compared to results obtained from a finite-Fermi-system theory and a large-basis shell-model calculation. The core-polarization and higher-order hindrance factors will be discussed. (orig.)

28692 (IPNO-DRE–91-28) **Concluding remarks of the international symposium on structure and reactions of unstable nuclei.** Mueller, A.C. Paris-11 Univ., 91 - Orsay (France). Inst. de Physique Nucleaire. [1991]. 11p. (CONF-9106205–: International symposium on structure and reactions of unstable nuclei, Niigata (Japan), 17-19 Jun 1991). Order Number DE94633243. Source: OSTI; NTIS (US Sales Only); INIS.

A brief history of unstable beams is given, followed by a short description of the experimental facilities. The structure and reaction of unstable nuclei is discussed, and the neutron-halo nuclei are studied. Some considerations are given related to exotic-beam facilities. (K.A.) 14 refs., 2 figs.

28693 (IPNO-TH–90-28) **Anharmonicity in extended RPA.** Beaumel, D.; Chomaz, Ph. Paris-11 Univ., 91 - Orsay (France). Inst. de Physique Nucleaire. Jan 1991. 42p. Order Number DE94633253. Source: OSTI; NTIS (US Sales Only); INIS.

An analytical formula for the calculation of the anharmonicity of the two-phonon state is presented which is based on a variational derivation of RPA-like equations for a many fermion system. Analytical estimations of the anharmonicity have been made using the Lipkin model and a degenerated schematic model. The formula obtained, together with the extended RPA predictions, have been checked by comparison with the exact solutions of the models. A rough estimation of the anharmonicity of the two phonon state built on the Giant Dipole Resonance and on the Giant Quadrupole Resonance has been deduced. (authors) 32 refs., 6 figs.

28694 (IPNO-TH–91-59) **Pionic values for deuteron observables.** Ballot, J.L. (Paris-11 Univ., 91 - Orsay (France). Inst. de Physique Nucleaire); Robilotta, M.R. Paris-11 Univ., 91 - Orsay (France). Inst. de Physique Nucleaire. [1991]. 13p. Order Number DE94633244. Source: OSTI; NTIS (US Sales Only); INIS.

A method for an unambiguous determination of deuteron asymptotic observables due to one pion exchange is presented. With this purpose in mind, an almost purely one pion exchange potential (OPEP) deuteron was constructed to study relationship between the corresponding limiting values of the external observables and the pion-nucleon coupling constant. (R.P.) 8 refs., 4 figs.

28695 (IPNO-TH–91-60) **Non-pionic effects in deuteron asymptotic observables.** Ballot, J.L. (Paris-11 Univ., 91 - Orsay (France). Inst. de Physique Nucleaire); Robilotta, M.R. Paris-11 Univ., 91 - Orsay (France). Inst. de Physique Nucleaire. [1991]. 10p. Order Number DE94633245. Source: OSTI; NTIS (US Sales Only); INIS.

It is well known that pion dynamics dominates deuteron asymptotic observables, especially η, the D/S ratio and Q, the quadrupole moment. A procedure has been discussed earlier that allows the unambiguous determination of the pion contribution to these observables as function of the pion-nucleon coupling constant. This problem is discussed in the framework of a specific model for the nucleon-nucleon interaction, namely the potential developed by the Tourreil, Rouben and Sprung. The contribution of non-pionic dynamics to deuteron asymptotic observables is investigated. It is shown that effects due to ρ and ω exchanges are negligible. (K.A.) 8 refs., 1 fig., 1 tab.

28696 (IPNO-TH–91-88) **Generator coordinate kernels between zero- and two-quasiparticle BCS states.** Tajima, N. (Paris-11 Univ., 91 - Orsay (France). Inst. de Physique Nucleaire); Flocard, H.; Bonche, P.; Dobaczewski, J.; Heenen, P.H. Paris-11 Univ., 91 - Orsay (France). Inst. de Physique Nucleaire. 19 Dec 1991. 19p. Order Number DE94633254. Source: OSTI; NTIS (US Sales Only); INIS.

A method is presented for the evaluation of the matrix elements of operators between BCS states with the generalized Wick's theorem even when the excitation of a pair of quasi-particles leads to the vanishing of the overlap. The behavior of the mean-field and the pairing contributions to the matrix elements of two-body operators versus the gauge angle of the orbital are analyzed, and it is found that each of them diverges as the overlap vanishes while their sum remains finite. A new definition of these quantities is proposed which removes the divergence occurring at zero overlap. A numerical application to a deformed heavy nucleus is done, which tests the feasibility of our prescription. (authors) 14 refs., 3 figs.

28697 (IPNO-TH–91-98) **Anharmonicities of nuclear vibrations from periodic mean-field orbits.** Abada, A. (Paris-11 Univ., 91 - Orsay (France). Div. de Physique Theorique); Vautherin, D. Paris-11 Univ., 91 - Orsay (France). Inst. de Physique Nucleaire. Dec 1991. 37p. Order Number DE94633255. Source: OSTI; NTIS (US Sales Only); INIS.

A new method for constructing periodic orbits of the time-dependent Hartree-Fock equations is proposed. It is based on a perturbative expansion in the amplitude of the collective vibration. Applications are presented to the case of octupole vibrations in ^{16}O and ^{40}Ca. From calculations performed up to second order the splitting of the two-phonon states are determined. The problems are discussed which, for the quadrupole mode, arise from a resonant coupling of the vibration with states of the continuum. (authors) 23 refs., 2 figs., 2 tabs.

28698 (JINR-E–4-93-58) **Nuclear structure and nuclear reactions at low and intermediate energies.** Jolos, R. Joint Inst. for Nuclear Research, Dubna (Russian Federation). 1993. 397p. (CONF-9209342–: International conference on nuclear structure and nuclear reactions at low and intermediate energies, Dubna (Russian Federation), 15-19 Sep 1992). Order Number DE94632190. Source: OSTI; NTIS (US Sales Only); INIS.

The reports of International conference on Nuclear Structure and Nuclear Reactions at low and intermediate energies has been presented.

6632 Radioactivity and Electromagnetic Transitions (Excluding Fission)

Refer also to citation(s) 28675, 28690, 28691

28699 (CEA-CONF–11695) **Shape transition and collective dynamics in even $^{94-100}Zr$ nuclei.** Skalski, J. (Soltan Inst. for Nuclear Studies, Otwock-Swierk (Poland)); Heenen, P.H.; Flocard, H.; Bonche, P. CEA Centre d'Etudes de Saclay, 91 - Gif-sur-Yvette (France). Service de Physique Theorique. 8 Dec 1992. 4p. (CONF-9208190–: 27. Zakopane School of Physics conference, Zakopane (Poland), 31 Aug - 3 sep 1992). Order Number DE94633274. Source: OSTI; NTIS (US Sales Only); INIS.

Quadrupole and octupole excitations in even $^{94-100}Zr$ nuclei were studied within the fully microscopic generator coordinate method, using a basis generated by the self-consistent Hartree-Fock method with the Skyrme force. Results relevant for the A=100 shape transition and for the octupole mode properties are reported. (authors) 17 refs., 1 fig., 1 tab.

28700 (IPNO-DRE–92-07) **Isoscalar spin excitation in ^{40}Ca.** Morlet, M. (Paris-11 Univ., 91 - Orsay (France). Inst. de Physique Nucleaire); Willis, A.; Van de Wiele, J.; Marty, N.; Johnson, B.N.; Bimbot, L.; Guillot, J.; Jourdan, F.; Langevin-Joliot, H.; Rosier, L.; Tomasi-Gustafsson, E.; Glashausser, C.; Beatty, D.Paris-11 Univ., 91 - Orsay (France). Inst. de Physique Nucleaire. [1992]. 21p. Order Number DE94633275. Source: OSTI; NTIS (US Sales Only); INIS.

Submitted to Phys. Rev., C (US).

A signature S_d^y of isoscalar spin-transfer strength has been tested in the inelastic scattering of 400 MeV deuterons from ^{12}C. It was then applied to the study of ^{40}Ca over an angular range from 3 deg to 7 deg (momentum transfer range from 0.26 to 0.8 fm^{-1}) and an excitation energy range from 6.25 to 42 MeV. This is the first study of isoscalar spin strength in the continuum. Spin excitations were found in the 9 MeV region, and over a broad range in the continuum with a cluster of strength around 15 MeV. The results are compared with spin-flip probability measurements in proton scattering. In contrast to the total relative spin response, which is strongly enhanced at high excitation, the isoscalar relative spin response is roughly consistent with non interacting Fermi gas values. (authors) 39 refs., 13 figs., 1 tab.

28701 (TRI-PP–90-9) **Integral cross sections for π^+p interactions at low energies.** Friedman, E. (Hebrew Univ., Jerusalem (Israel). Racah Inst. of Physics); Goldring, A.; Wagner, G.J.; Altman, A.; Johnson, R.R.; Meirav, O.; Jennings, B.K. TRIUMF, Vancouver, BC (Canada). Feb 1990. 12p. Order Number DE94633260. Source: OSTI; NTIS (US Sales Only); INIS.

Submitted to Nuclear Physics A.

Integral cross sections for the elastic scattering of π^+ by protons into angles greater than 20 degrees or 30 degrees (lab.) have been measured by the beam-attenuation technique over the energy range of 45 to 126 MeV. The measurements are aimed at providing independent checks on the absolute normalization of differential cross sections, where discrepancies exist between different data sets. Comparisons with predictions made with existing phase shifts show very good agreement with the dispersion-relation constrained phase shifts of the Karlsruhe group. (Author) 19 refs., 3 tabs., 3 figs.

28702 (TRI-PP–91-9) **Isospin and quarks in nuclear beta-decay.** Wilkinson, D.H. (Sussex Univ., Brighton (United Kingdom)). TRIUMF, Vancouver, BC (Canada). Apr 1991. 19p. (CONF-9103165–: International conference on spin and isospin in nuclear interactions, Telluride, CO (United States), 11-15 Mar 1991). Order Number DE94633262. Source: OSTI; NTIS (US Sales Only); INIS.

This paper exposes in some detail the technical problems relating to the extraction of the vector coupling constant from the beta decay of complex nuclei. It also considers the extraction of the axial coupling constant from the beta-decay of the neutron. The internal consistency of all data relating to beta-decay, including that of the muon, is also examined, within the standard model, with a view to the possible intervention of W_R. (Author) 52 refs., 4 figs., 2 tabs.

28703 (TRI-PP–91-12) **Non-mesonic weak decay of $^{12}_{\Lambda}C$.** Ramos, A.; Bennhold, C.; van Meijgaard, E.; Jennings, B.K. TRIUMF, Vancouver, BC (Canada). Apr 1991. 11p. Order Number DE94633261. Source: OSTI; NTIS (US Sales Only); INIS.

The non-mesonic weak decay of $^{12}_{\Lambda}C$ is evaluated in a relativistic nuclear model that includes the final state interaction of the ejected nucleons along with a realistic ΛN-correlation function in the initial state. Contributions from the p-shell nucleons, neglected in previous nuclear matter computations, change the total rate by a factor of two. We find that with this nuclear structure input the $\Lambda N \rightarrow NN$ pion exchange model alone is insufficient to reproduce experimental data. The inclusion of kaon exchange cannot remedy the situation.

6633 Nuclear Reactions and Scattering, General

Refer also to citation(s) 28586, 28697

28704 (GANIL-P–93-31) **Fluctuations in the fragmentation process.** Botet, R. (Paris-11 Univ., 91 - Orsay (France). Lab. de Physique des Solides); Ploszajczak, M. Grand Accelerateur National d'Ions Lourds (GANIL), 14 - Caen (France). 1993. 29p. (CONF-9308199–: 23. Mazurian Lakes summer school on nuclear physics: Frontier topics in nuclear, astronuclear and astroparticle physics, Piaski (Poland), 18-28 Aug 1993). Order Number DE94633281. Source: OSTI; NTIS (US Sales Only); INIS.

Some general framework of sequential fragmentation is presented, as provided by the newly proposed Fragmentation - Inactivation - Binary model, and to study briefly its basic and universal features. This model includes as particular cases most of the previous kinetic fragmentation models. In particular it is discussed how one arrives in this framework to the critical behaviour, called the shattering transition. This model is then compared to recent data on gold multifragmentation at 600 MeV/nucl. (authors) 20 refs., 5 figs.

28705 (IPNO-TH–92-05) **Observables in nuclear fragmentation: finite size scaling.** Campi, X. (Paris-11 Univ., 91 - Orsay (France). Div. de Physique Theorique); Krivine, H. Paris-11 Univ., 91 - Orsay (France). Inst. de Physique Nucleaire. Mar 1992. 17p. Order Number DE94633282. Source: OSTI; NTIS (US Sales Only); INIS.

The method of moments correlations is studied as a tool to discriminate between different fragmentation mechanisms. Various methods of characterizing the distribution and their ability to differentiate between various fragmentation mechanisms are considered. It is shown, using simple models, that the variance of the fragment distribution, the size of the heaviest residue and the scaling of these quantities with the size of the fragmenting system give

significant insight into the nature of the fragmentation mechanism. (authors) 28 refs., 5 figs.

28706 (UCRL-JC–117466) **Continuum angular distributions in nuclear reactions: Physical basis for the Kalbach systematics.** Chadwick, M.B. (Lawrence Livermore National Lab., CA (United States)); Oblozinsky, P. Lawrence Livermore National Lab., CA (United States). 1 Jun 1994. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-9406200–2: 7. international conference on nuclear reaction mechanisms, Vaienna (Italy), 6-11 Jun 1994). Order Number DE94016176. Source: OSTI; NTIS; INIS; GPO Dep.

We show how the conservation of linear momentum is fundamental to the description of angular distributions in preequilibrium nuclear reactions. By using state densities with linear momentum to describe the phase space during the preequilibrium cascade, angular distributions can be derived in a transparent way. Fermi-motion and Pauli-blocking effects are included, and correlations between the emission particle's energy and angle are obtained for all orders of scattering. Our model provides a physical basis for the widely-used phenomenological systematics of Kalbach, and provides a framework for understanding the systematical properties of continuum angular distributions.

6634 Specific Nuclear Reactions and Scattering

Refer also to citation(s) 28104, 28108, 28114, 28303, 28649, 28683, 28684, 28697, 28758

28707 (ANL/PHY/CP–83522) **Electron scattering from polarized deuterium at VEPP-3.** Jones, C.E. (and others); Holt, R.J.; Kowalczyk, R. Argonne National Lab., IL (United States). [1994]. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-940514–8: Intersections of particle and nuclear physics, St. Petersburg, FL (United States), 31 May - 6 jun 1994). Order Number DE94016330. Source: OSTI; NTIS; INIS; GPO Dep.

The status, results, and future plans for the experiment measuring the tensor analyzing power of the deuteron using a tensor-polarized internal target at the VEPP-3 electron storage ring in Novosibirsk are presented.

28708 (BNL–49934) **Particle spectra and correlations from Experiment 814.** Stachel, J. E814 Collaboration: BNL-GSI-McGill Univ.-Univ. of New Mexico-Univ. of Pittsburgh-SUNY Stony Brook-Univ. of Sao Paulo-Wayne State Univ.-Yale Univ. State Univ. of New York, Stony Brook, NY (United States). Dept. of Physics. [1994]. 8p. Sponsored by USDOE, Washington, DC (United States);National Science Foundation, Washington, DC (United States);Natural Sciences and Engineering Research Council of Canada, Ottawa, ON (Canada). DOE Contract AC02-76CH00016. (CONF-930636–15: 10. international conference on ultra-relativistic nucleus-nucleus collisions, Borlaenge (Sweden), 20-24 Jun 1993). Order Number DE94015731. Source: OSTI; NTIS; INIS; GPO Dep.

In this article the authors summarize recent results from the E814 forward spectrometer on proton and pion distributions that give insight into the initial baryon (and energy) density achieved in central collisions as well as the temperature of the system at freeze-out. An independent measure for the latter, complementing the slope constants of particle spectra, is the population of nucleon excited states, in particular the $\Delta(1232)$ resonance. Besides its influence on the pion spectra it has also been identified directly in the experiment and first results are discussed. The first results from E814 on kaon spectra at low transverse momentum p_t are presented; the spectra show an unexpected very steep rise at the lowest p_t. The two pion correlation function has been studied for positive and negative pions and the authors show that it is consistent with a large source size at freeze-out. Finally, they show that the present data give a consistent picture of a system in thermal and chemical equilibrium at freeze-out.

28709 (BNL–49935) **Pion interferometry in ^{28}Si + Pb central collisions.** Xu, Nu. E814 Collaboration: BNL-GSI-McGill Univ.-Univ. of Pittsburg-SUNY Stony Brook-Univ. of Sao Paulo-Wayne State Univ.-Yale Univ. State Univ. of New York, Stony Brook, NY (United States). Dept. of Physics. [1994]. 5p. Sponsored by USDOE, Washington, DC (United States);National Science Foundation, Washington, DC (United States);Natural Sciences and Engineering Research Council of Canada, Ottawa, ON (Canada). DOE Contract AC02-76CH00016. (CONF-930636–14: 10. international conference on ultra-relativistic nucleus-nucleus collisions, Borlaenge (Sweden), 20-24 Jun 1993). Order Number DE94015733. Source: OSTI; NTIS; INIS; GPO Dep.

Two-pion correlation functions have been studied using the E814 apparatus in 14.6 A·GeV/c ^{28}Si + Pb central collisions. Results of the correlation functions for pions from the RQMD event generator are compared to the data and show that a source with RMS radius of 8.3 fm is compartable with the experimental data.

28710 (BNL–49936) **Electromagnetic dissociation of relativistic Si via giant dipole resonance.** Sonnadara, U.J. (Pittsburgh Univ., PA (United States). Dept. of Physics and Astronomy). E814 Collaboration. Brookhaven National Lab., Upton, NY (United States). [1993]. 7p. Sponsored by USDOE, Washington, DC (United States);National Science Foundation, Washington, DC (United States). DOE Contract AC02-76CH00016. (CONF-930867–5: Gull Lake nuclear physics conference on giant resonances, Gull Lake, MI (United States), 17-21 Aug 1993). Order Number DE94015729. Source: OSTI; NTIS; INIS; GPO Dep.

A detailed study of the electromagnetic dissociation of ^{28}Si in extremely peripheral collisions at 14.6 GeV/nucleon was carried out with ^{28}Si projectiles interacting on Pb, Sn, Cu and Al targets. The excitation energy is determined by measurements of the invariant mass of the excited system. We examine the decay channels 1p+^{27}Al, I+^{27}Si and 2p+^{26}Mg. The excitation energy distributions are well reproduced by combining the photon spectrum calculated using the Weizsaecker-Williams approximation with the experimental data on the photonuclear cross sections. No evidence for double photon excitation of ^{28}Si is observed.

28711 (BNL–49937) **Low p_t pion enhancement in ^{28}Si + Pb collisions at 14.6 A GeV/c.** Hemmick, T.K. (State Univ. of New York, Stony Brook, NY (United States). Dept. of Physics). Brookhaven National Lab., Upton, NY (United States). [1994]. 5p. Sponsored by USDOE, Washington, DC (United States);Natural Sciences and Engineering Research Council of Canada, Ottawa, ON (Canada). DOE Contract AC02-76CH00016. (CONF-930636–16: 10. international conference on ultra-relativistic nucleus-nucleus collisions, Borlaenge (Sweden), 20-24 Jun 1993). Order Number DE94015732. Source: OSTI; NTIS; INIS; GPO Dep.

The pion is produced copiously in nucleus-nucleus collisions at AGS energies and is expected to be easily thermalized due to its large cross section for interaction in dense nuclear matter. Pion enhancement at low transverse momentum has been predicted as the result of a variety of processes. For example, the decay of the $\Delta(1232)$ resonance is expected to be a major source of such enhancement and has been proposed as an alternative measure of the system temperature. The nucleons and pions produced as the daughters of the Δ share their parent's energy and thereby produce a cold component of the pion spectrum. The delta resonance is believed to be a major contributor to the imaginary part of the scattering amplitude of the pion in dense baryon rich matter. Here the author presents the first results from identified pion spectra from AGS experiment E814.

28712 (BNL–49943) **Preliminary results from the E814 Target Rapidity Telescope.** Bennett, S.J. (Wayne State Univ., Detroit, MI (United States). Dept. of Physics and Astronomy). Brookhaven National Lab., Upton, NY (United States). [1994]. 3p. Sponsored by USDOE, Washington, DC (United States);National Science Foundation, Washington, DC (United States). DOE Contract AC02-76CH00016. (CONF-930173–22: HIPAGS 93: workshop on heavy ion physics at the alternating gradient synchrotron, Cambridge, MA (United States), 14-17 Jan 1993). Order Number DE94015730. Source: OSTI; NTIS; INIS; GPO Dep.

The author presents preliminary results for the π/p and p/d ratios obtained from the Target Rapidity Telescope recently installed in E814.

28713 (BNL–60505) **Proton-lead nuclear reaction cross-section.** Takahashi, Hiroshi; Takashita, Hirofumi; Chen, Xinyi. Brookhaven National Lab., Upton, NY (United States). [1991]. 15p.

Sponsored by Japan Atomic Energy Research Inst., Tokyo (Japan). DOE Contract AC02-76CH00016. (CONF-9405137–5: NEA/OECD/NSC specialists meeting on intermediate energy nuclear data (IEND) codes, Paris (France), 30 May - 1 jun 1994). Order Number DE94014261. Source: OSTI; NTIS; INIS; GPO Dep.

Subcritical reactors driven by proton accelerators have been studied as transmutation systems. In those systems, the lack of neutrons is mitigated by the spallation reaction, using high-energy protons. Usually, lead is selected as the target nucleus to produce neutrons. Therefore, it is important to study the nuclear reaction between high-energy protons and lead nuclei in order to design such a transmutation system. Using the LAHET and XSEX codes, we calculated the differential production cross-sections of neutrons and protons when a high-energy proton hits a lead nucleus. The calculation models we used were the Bertini model and the ISABEL model. For the former, we investigated two cases in which the pre-equilibrium process was either taken into account or was not.

28714 (BNL–60633) **A relativistic cascade for heavy ion collisions.** Schlagel, T.J.; Pang, Y.; Kahana, S.H. Brookhaven National Lab., Upton, NY (United States); State Univ. of New York, Stony Brook, NY (United States). Jul 1994. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH00016 ; FG02-93ER40768. (CONF-940514–5: Intersections of particle and nuclear physics, St. Petersburg, FL (United States), 31 May - 6 jun 1994). Order Number DE94015846. Source: OSTI; NTIS; INIS; GPO Dep.

Au on Au collisions at the BNL/AGS (11.6 GeV-A/c) are expected to produce a short-lived state of matter at high baryon density. If the baryons reach sufficiently high density, they may produce a quark-gluon plasma (QGP). The signals from a QGP phase may be difficult to distinguish from those of ordinary hadronic matter. The authors have constructed a relativistic cascade (ARC) for hadrons in an attempt to model the dynamics of ordinary hadronic matter in a heavy ion collision, in the hopes that deviations from the cascade results may indicate new physics. In this contribution the authors discuss the formation of high baryon density matter, and its effect on antiproton production.

28715 (CEA-CONF–11708) **Feasibility study of T-violation with Van Vleck or quadrupolar nuclei.** Goldman, M. CEA Centre d'Etudes de Saclay, 91 - Gif-sur-Yvette (France). Dept. de Recherche sur l'Etat Condense, les Atomes et les Molecules. 1993. 6p. (CONF-9305235–: International workshop/time reversal invariance and parity violation in neutron physics, Dubna (Russian Federation), 4-7 May 1993). Order Number DE94633305. Source: OSTI; NTIS (US Sales Only); INIS.

Two methods of production of nuclear polarization non-aligned with the magnetic field are described, for the purpose of studying T-violation in neutron-nucleus interactions. The first one uses nuclei belonging to Van Vleck ions and the second one uses nuclei experiencing a quadrupole interaction. These methods are based on detecting the anisotropy of the attenuation of a neutron beam crossing a sample. (K.A.) 21 refs.

28716 (CEA-CONF–11710) **Transverse and longitudinal response functions in (e,e'p) scattering off light nuclei.** Marchand, C. CEA Centre d'Etudes de Saclay, 91 - Gif-sur-Yvette (France). Dept. d'Astrophysique, de la Physique des Particules, de la Physique Nucleaire et de l'Instrumentation Associee. 23 Nov 1993. 5p. (CONF-930637–: 13. international conference on particles and nuclei, Perugia (Italy), 27 Jun - 3 jul 1993). Order Number DE94633294. Source: OSTI; NTIS (US Sales Only); INIS.

The latest results in (e,e'p) reactions on few-body nuclei are reported, especially recent experimental determinations of the longitudinal and transverse structure functions for $^{2}H(e,e'p)n$ and $^{3}He(e,e'p)^{2}H$. These new precise data allow a thorough study of the reaction mechanism of the (e,e'p) reaction at momentum transfers up to one GeV. The data are compared to theoretical descriptions of the (e,e'p) cross sections which include final state interactions, meson exchange currents and relativistic effects by consistently solving the scattering problem. (author) 12 refs., 2 figs.

28717 (CEA-CONF–11712) **Determination of the neutron spin structure function.** Staley, F. E142 Collaboration. CEA Centre d'Etudes de Saclay, 91 - Gif-sur-Yvette (France). Dept. d'Astrophysique, de la Physique des Particules, de la Physique Nucleaire et de l'Instrumentation Associee. 23 Nov 1993. 3p. (CONF-930761–: International Europhysics conference on high-energy physics, Marseille (France), 22-28 Jul 1993). Order Number DE94633295. Source: OSTI; NTIS (US Sales Only); INIS.

New measurements of the neutron spin structure function, $g_1(x)$, made at SLAC are reported, using longitudinally polarized electrons on a polarized ^{3}He target. The spin structure function of the neutron has been determined from $x=0.03$ to $x=0.6$ at an average Q^2 of 2 $(GeV/c)^2$, by measuring the asymmetry in deep inelastic scattering of polarized electrons from polarized ^{3}He at energies from 19 to 26 GeV. The integral over the spin structure function has been calculated. (author) 16 refs., 3 figs., 1 tab.

28718 (CRN-PN–91-11) **Liquid-vapor phase transition, collective flow and entropy determination from future measurements of intermediate mass fragments.** Coffin, J.P. Strasbourg-1 Univ., 67 (France). Centre de Recherches Nucleaires. 1991. 12p. (CONF-9105429–: 7. Adriatic international conference on nuclear physics: heavy ion physics - today and tomorrow, Brijuni (Yugoslavia), 27 May - 1 jun 1991). Order Number DE94633319. Source: OSTI; NTIS (US Sales Only); INIS.

Some global variables reflecting the highly collective character of nuclear matter produced in relativistic heavy-ion collisions are briefly reviewed on the basis of presently available experimental results and of Quantum Statistical Model and Quantum Molecular Dynamic Model predictions relative to intermediate mass fragments. Possible future measurements are suggested. (author) 27 refs., 8 figs.

28719 (CRN-PN–91-17) **The 4π-collaboration at SIS/ESR: Physics program and first experimental results.** Rami, F. 4pi Collaboration. Strasbourg-1 Univ., 67 (France). Centre de Recherches Nucleaires. [1991]. 19p. (CONF-9108212–: Symposium on nuclear physics, Tours (France), 29-31 Aug 1991). Order Number DE94633320. Source: OSTI; NTIS (US Sales Only); INIS.

A new generation of 4π experiments aiming at the investigation of the properties of compressed and heated nuclear matter produced in heavy-ion collisions in the incident energy range .1 to 2. GeV/nucleon, is presently starting at the SIS/ESR facility at GSI-Darmstadt. The new 4π-instrument is described. A first experiment was focused on the production of composite particles in central and semi central collisions of $^{197}Au+^{197}Au$ at incident energies between 100 and 800 MeV/nucleon. Preliminary results indicate that the charged particle multiplicity measurement alone cannot be used to select the most central collisions, and new selection criteria are suggested. They also show the ability of the detection system to sort out, with reasonable statistics, high degree multifragment events, i.e. events where a large fraction of the total initial charge is going into a few big clusters ($Z \geq 6$). (R.P.) 20 refs., 14 figs.

28720 (DOE/ER/40270–53) **Polarization observables in pion photoproduction on light nuclei.** Tiator, L. (Universitaet Mainz (Germany). Institut fuer Kernphysik); Kamalov, S.S.; Bennhold, C. George Washington Univ., Washington, DC (United States). [1994]. 15p. Sponsored by USDOE, Washington, DC (United States);Deutsche Forschungsgemeinschaft, Bonn (Germany). DOE Contract FG05-86ER40270. (CONF-9305241–5: 6. international workshop on perspectives in intermediate energy nuclear physics, Trieste (Italy), 4-7 May 1993). Order Number DE94015488. Source: OSTI; NTIS; INIS; GPO Dep.

Single polarization observables Σ, P, and T are investigated for the nucleon (p, n) and the trinucleon (^{3}He, ^{3}H). The threshold E_{0+} and the resonance M_{1+} and E_{1+} multipoles are particularly studied. For the reaction $^{3}He(\gamma, \pi^{+})^{3}H$ a recently developed nonlocal coupled-channel approach is presented that employs three-body Faddeev amplitudes and incorporates two-step processes such as $^{3}He(\gamma, \pi^{o})^{3}He(\pi^{o}, \pi^{+})^{3}H$. Enhancement effects of the contributions from small components of the ^{3}He wave function as well as from the Δ resonance E2 transition to the polarization observables have been found.

28721 (GANIL-P–92-11) **The Boltzmann-Langevin model for nuclear collisions.** Ayik, S. (Tennessee Technological Univ., Cookeville, TN (United States)); Suraud, E.; Belkacem, M.; Boilley, D. Grand Accelerateur National d'Ions Lourds (GANIL), 14 - Caen

(France). [1992]. 13p. Order Number DE94633321. Source: OSTI; NTIS (US Sales Only); INIS.

An extension of the one-body transport models is developed by incorporating correlations into the equation of motion in a stochastic approximation. In the semiclassical limit, this yields the Boltzmann-Langevin Equation for the fluctuating single-particle density in the phase-space. In order to investigate the gross-properties of density fluctuations in heavy-ion collisions, a number of calculations have been carried out. These calculations reveal that large dynamical fluctuations are introduced into the momentum space during the early stages of the collision, which cause the nuclear system to decay into a great variety of final channels. The effects of the fluctuations on the kaon production in heavy-ion collisions at sub-threshold energies are also investigated. (authors) 25 refs., 3 figs., 1 tab.

28722 (GANIL-P–92-12) **Multiparticle correlations and intermittency in high energy collisions.** Bozek, P. (Grand Accelerateur National d'Ions Lourds (GANIL), 14 - Caen (France)). Grand Accelerateur National d'Ions Lourds (GANIL), 14 - Caen (France). [1992]. 78p. Order Number DE94633306. Source: OSTI; NTIS (US Sales Only); INIS.

An analysis of the intermittency signal observed in high energy experiments is presented using multiparticle distributions and correlation functions. The effect of the dimensional projection of the multiparticle distributions on one or two-dimensional subspace is discussed. The structure of the multiparticle cumulants is analyzed for the DELPHI e^+e^- annihilation data. The model of spatiotemporal intermittency is discussed in details and is shown to reproduce qualitatively the dependence of the intermittency strength on the target and projectile nuclei. A 1-dimensional (ID) cellular-automaton (CA) and a ID forest-fire model is studied. On the example of the noncritical ID Ising model the difficulties of the scaled factorial moment (SFM) method in extracting genuine scaling behaviour are illustrated. The problem of the finite-size effect in connection to the dimensional projection can be easily exemplified in the case of the 2D critical system with conformal symmetry. (R.P.) 122 refs., 38 figs., 3 tabs.

28723 (HW–58817) **The effective (n,2n) cross section for U-238.** Nilson, R. Battelle, Columbus, OH (United States). 9 Jan 1959. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE94015971. Source: OSTI; NTIS; GPO Dep.

Neptunium-237 is currently produced in the Hanford reactors at a rate of approximately .003 gms/MWD via the following reactions: (a) U^{238} (n,2n) $U^{237}\beta\rightarrow$ Np^{237}. (b) U^{235} (n,γ) U^{236} (n,γ) $U^{237}\beta\rightarrow$ Np^{237}. In order to calculate the buildup of Np^{237} via reaction (a), which accounts for the greater share of the formation of Np^{237}, the n,2n cross section for U^{238} must be known. An old value quoted by Arnold of 5.2 millifermis for an "effective" 2200 m/s value is not large enough to account for the observed Np^{237} yield by about a factor of two. Recent n,2n cross section measurements for U^{238} permit a newer calculation and the result is 11.2 mF, effective 2200 m/s value.

28724 (IPNO-DRE–91-31) **Study of light neutron-deficient nuclei with the LISE3 spectrometer.** Borrel, V. (Paris-11 Univ., 91 - Orsay (France). Inst. de Physique Nucleaire); Dogny, S.; Guillemaud-Mueller, D.; Mueller, A.C.; Pougheon, F.; Sorlin, O.; Anne, R.; Borcea, C.; Fifield, L.K.; Lewitowicz, M.; Saint-Laurent, M.G.; Bazin, D.; Del Moral, R.; DParis-11 Univ., 91 - Orsay (France). Inst. de Physique Nucleaire. [1991]. 8p. (CONF-9108236–: 2. International conference on radioactive nuclear beams, Louvain-la-Neuve (Belgium), 19-21 Aug 1991). Order Number DE94633322. Source: OSTI; NTIS (US Sales Only); INIS.

Neutron-deficient isotopes with Z=21 to 26 are produced among the projectile-like fragments of an intense ^{58}Ni GANIL beam of 69 MeV/nucleon. The nuclei selected by the upgraded LISE3 spectrometer are identified and implanted in a silicon detector telescope where their emitted charged particles are measured. ^{43}Cr, ^{47}Fe and ^{46}Fe isotopes are synthesized for the first time, whereas ^{45}Fe, ^{45}Mn and ^{42}V remain unobserved. The half-lives of ^{43}Cr and ^{46}Mn are measured, and the analysis of their beta-delayed proton spectra leads, through the isobaric multiplet mass equation, to an experimental value for their excess mass. (author) 13 refs., 5 figs., 3 tabs.

28725 (IPNO-DRE–91-34) **The J/ψ suppression revisited once more.** Gerschel, C. NA38 Collaboration. Paris-11 Univ., 91 - Orsay (France). Inst. de Physique Nucleaire. [1991]. 13p. (CONF-9109543–: Conference 'Hadron structure 91', Stara-Lesna (Czech Republic), 16-19 Sep 1991). Order Number DE94633323. Source: OSTI; NTIS (US Sales Only); INIS.

NA38 results concerning J/ψ production in collisions induced by oxygen and sulphur ions are interpreted in terms of initial state interactions and final state absorption in interactions of J/ψ's with nucleons. The J/ψ absorption seems similar in p-nucleus and nucleus-nucleus collisions. There is no evidence for the formation of a quark gluon plasma. This conclusion has been possible owing to the introduction of a new variable which is suitable for the comparison of p-nucleus and nucleus-nucleus collisions. (author) 18 refs., 4 figs., 1 tab.

28726 (IPNO-DRE–91-37) **Compilation, measurements and tabulation of heavy ion stopping data.** Bimbot, R. Paris-11 Univ., 91 - Orsay (France). Inst. de Physique Nucleaire. [1991]. 20p. (CONF-9108129–: North Atlantic Treaty Organization (NATO) ARW conference on complex dynamics and biological evolution, Middelfart (Denmark), 5-10 Aug 1991). Order Number DE94633324. Source: OSTI; NTIS (US Sales Only); INIS.

New stopping power measurements have been carried out with heavy ions in the last 15 years, and they resulted in new stopping power tabulations. A synthesis of these studies is presented and a chronological presentation has been adopted. Low energy (3-6 MeV/u) and intermediate energy (20-100 MeV/u) stopping power measurements are both investigated. (K.A.) 35 refs., 15 figs.

28727 (IPNO-DRE–92-02) **Excitation of the Δ resonance in the nuclear medium through charge exchange reactions.** Ramstein, B. (Paris-11 Univ., 91 - Orsay (France). Inst. de Physique Nucleaire); Hennino, T.; Bachelier, D.; Jourdain, J.C.; Roy-Stephan, M.; Bohlen, H.G.; Lemaire, M.C.; Morsch, H.P.; Radvanyi, P.; Boyard, J.L.; Zupranski, P.; Gosset, J. Paris-11 Univ., 91 - Orsay (France). Inst. de Physique Nucleaire. [1992]. 8p. (CONF-9109127–: Workshop on baryon spectroscopy and the structure of the nucleon, Saclay (France), 23-25 Sep 1991). Order Number DE94633314. Source: OSTI; NTIS (US Sales Only); INIS.

Data are presented on the decay of the Δ resonance excited in ^1H, ^2H and ^{12}C by the (^3He,t) reaction at 2 GeV incident energy. In the energy transfer spectra, the same position and width of the Δ resonance have been observed on the three targets when one π^+ and one proton is detected in coincidence with the triton. On the ^{12}C target, the Δ peak associated with the detection of 2 protons is shifted by 100 MeV towards lower excitation energy. (authors) 14 refs., 5 figs.

28728 (IPNO-DRE–92-03) **Time-scales in H.I. collisions around the Fermi energy - limits for thermalization of hot nuclei and multifragmentation.** Borderie, B. Paris-11 Univ., 91 - Orsay (France). Inst. de Physique Nucleaire. Jan 1992. 19p. Order Number DE94633325. Source: OSTI; NTIS (US Sales Only); INIS.

Formation and decay of highly excited nuclei in intermediate-energy heavy-ion collisions is investigated. The problem of what the highest energy is these nuclei can absorb and still behave as thermally equilibrated systems is discussed. In other words, at what excitation energy per nucleon is the energy relaxation time comparable to the life-time of the hot nuclei produced. From these time-scales some predictions are derived concerning maximum thermalized energy or highest initial temperatures of hot nuclear systems. Finally, possible fast multifragment emissions are discussed. (K.A.) 46 refs., 7 figs., 1 tab.

28729 (IPNO-TH–91-63) **Effect of the treatment of Pauli blocking on dynamical multifragmentation calculations.** Nemeth, J. (Laboratoire National Saturne, Centre d'Etudes de Saclay, 91 - Gif-sur-Yvette (France)); Ngo, C. Paris-11 Univ., 91 - Orsay (France). Inst. de Physique Nucleaire. [1991]. 9p. Order Number DE94633326. Source: OSTI; NTIS (US Sales Only); INIS.

Molecular dynamics calculations, are used to obtain the atomic number distribution of the fragments produced in the O+AgBr system between 50 and 200 MeV/u. This calculation is made with a new approach to the Pauli blocking. A good agreement with experimental data is obtained, in particular concerning the onset of nuclear multifragmentation. The influence of different prescriptions for the Pauli blocking and for the nucleon-nucleon cross section is also compared. (K.A.) 10 refs., 4 figs.

28730 (JINR-E-4-93-58, pp. 304-313) **Fermi and Gamow-Teller transitions in $^{12-14}$C(^{3}He,t)$^{12-14}$N charge exchange and the splitting and fragmentation of Gamow-Teller strength in $^{112-124}$Sn(^{3}He,t)$^{112-124}$Sb.** Janesce, J. Joint Inst. for Nuclear Research, Dubna (Russian Federation). 1993. 397p. (CONF-9209342–: International conference on nuclear structure and nuclear reactions at low and intermediate energies, Dubna (Russian Federation), 15-19 Sep 1992). In *NSNR - Nuclear structure and nuclear reactions at low and intermediate energies.* Order Number DE94632190. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. CARBON ISOTOPES/helium 3 reactions; HELIUM 3 REACTIONS/charge-exchange reactions; TIN ISOTOPES/helium 3 reactions

28731 (LA-UR–94-1581) **Lead 207, 208 (n, xn gamma) reactions for neutron energies up to 200 MeV.** Pavlik, A. (Univ. Wien (Austria). Inst. fuer Radiumforschung und Kernphysik); Vonach, H.; Chadwick, M.B.; Haight, R.C.; Nelson, R.O.; Wender, S.A.; Young, P.G. Los Alamos National Lab., NM (United States). [1994]. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-940507–30: International conference on nuclear data for science and technology, Gatlinburg, TN (United States), 9-13 May 1994). Order Number DE94014803. Source: OSTI; NTIS; INIS; GPO Dep.

High-resolution γ-ray spectra from the interaction of neutrons in the energy range from 3 to 200 MeV with ^{207,208}Pb were measured with the white neutron source at the WNR facility at Los Alamos National Laboratory. From these data, excitation functions for prominent γ transitions in ^{200,202,204,206,207,208}Pb were derived from threshold to 200 MeV incident neutron energy. These γ-production cross sections represent formation cross sections for excited states of the residual nuclei. The results are compared with the predictions of nuclear reaction calculations based on the exciton model for precompound emission, the Hauser-Feshbach theory for compound nuclear decay, and coupled channels calculations to account for direct excitation of collective levels. Good agreement was obtained over the entire energy range covered in the experiment with reasonable model parameters. The results demonstrate that multiple preequilibrium emission has to be taken into account above about 40 MeV, and that the level density model of Ignatyuk should be used instead of the Gilbert-Cameron and back-shifted Fermi-gas models if excitation energies exceed about 30 MeV.

28732 (LA-UR–94-1592) **Alpha-particle emission from carbon bombarded with neutrons below 30 MeV.** Haight, R.C. (and others); Lee, T.M.; Sterbenz, S.M. Los Alamos National Lab., NM (United States). [1994]. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-940507–26: International conference on nuclear data for science and technology, Gatlinburg, TN (United States), 9-13 May 1994). Order Number DE94014800. Source: OSTI; NTIS; INIS; GPO Dep.

Alpha-particle emission induced by neutron bombardment of carbon has been studied from threshold to over 30 MeV using the spallation neutron source at WNR/LAMPF. Targets include thin foils of CH_2 and thicker foils of CH and polycrystalline graphite. Comparisons are made with evaluated data. Values for KERMA (kinetic energy released in materials) based on the results will be presented and compared with those obtained through other experimental approaches.

28733 (LA-UR–94-1594) **Neutron-induced charged-particle emission studies below 100 MeV at WNR.** Haight, R.C. (and others); Lee, T.M.; Sterbenz, S.M. Los Alamos National Lab., NM (United States). [1994]. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-940507–29: International conference on nuclear data for science and technology, Gatlinburg, TN (United States), 9-13 May 1994). Order Number DE94014797. Source: OSTI; NTIS; INIS; GPO Dep.

Charged-particles produced by neutron bombardment of selected targets with Z=5 through 53 have been studied for neutron energies from 1 MeV to about 100 MeV using the spallation neutron source at WNR/LAMPF. Particle detection with energy measurement and particle identification is accomplished by two-element ΔE-E counters, three-element ΔE_1-ΔE_2-E counters or with pulse-shape discrimination using scintillators directly in the neutron beam. The experimental techniques for these measurements are described and comparisons made among the different approaches. This presentation introduces five papers contributed to this conference.

28734 (LA-UR–94-1907) **Progress in applying the FKK multistep reaction theory to intermediate-energy data evaluation.** Chadwick, M.B. (Lawrence Livermore National Lab., CA (United States)); Young, P.G. Lawrence Livermore National Lab., CA (United States). [1994]. 12p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36 ; W-7405-ENG-48. (UCRL-JC–117460; CONF-9405188–1: Organization for Economic Co-Oeration and Development conference meeting on intermediate energy nuclear data, Issy-les-Moulineaux (France), 30 May - 1 jun 1994). Order Number DE94014458. Source: OSTI; NTIS; INIS; GPO Dep.

Recent developments to the physics modeling in the FKK-GNASH code system are reviewed. We describe modifications to include a linking of multistep direct and multistep compound processes, which are important when the incident energy is less than about 30 MeV. A model for multiple preequilibrium emission is given, and compared with experimental measurements of proton reactions on ^{90}Zr at 160 MeV. We also give some preliminary observations concerning FKK calculations which use both normal and non-normal DWBA matrix elements. We describe the application of the FKK-GNASH code to a range of nuclear data applications, including intermediate energy reactions of importance in the accelerator transmutation of waste, and fast neutron and proton cancer radiation treatment. We outline areas where further work is needed for the accurate modeling of nuclear reactions using the FKK theory.

28735 (LA-UR–94-2420) **Quasi-elastic and continuum scattering of 500-MeV pions.** Zumbro, J.D. Los Alamos National Lab., NM (United States). [1994]. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-940514–7: Intersections of particle and nuclear physics, St. Petersburg, FL (United States), 31 May - 6 jun 1994). Order Number DE94016293. Source: OSTI; NTIS; INIS; GPO Dep.

Results for the scattering of 500-MeV pions are compared to the (e,e′) data and to Intra-Nuclear cascade calculations. The (π, π′) spectra, which are remarkably similar in shape to the (e,e′) spectrum, show a large enhancement in the region corresponding to resonant-energy pions. Possible mechanisms for this "pion transparency" are suggested.

28736 (LPN–93-04) **Study of energy deposition in heavy-ion reactions.** Mota, V. De La; Abgrall, P.; Sebille, F.; Haddad, F. Nantes Univ., 44 (France). 1993. 19p. Order Number DE94633328. Source: OSTI; NTIS (US Sales Only); INIS.

An investigation of energy deposition mechanisms in heavy-ion reactions at intermediate energies is presented. Theoretical simulations are performed in the framework of the semi-classical Landau-Vlasov model. They emphasize the influence of the initial non-equilibrium conditions, and the connection with the incident energy is discussed. Characteristic times involved in the energy thermalization process and finite size effects are analyzed. (authors) 20 refs., 4 figs.

28737 (LPN–93-18) **Coherent pion production in nucleus-nucleus reactions.** Erazmus, B. Nantes Univ., 44 (France). 1993. 10p. (CONF-930999–: NATO Advanced Study Institute on hot and dense nuclear matter, Bodrum (Turkey), 26 Sep - 9 oct 1993). Order Number DE94633315. Source: OSTI; NTIS (US Sales Only); INIS.

Results from two earlier experiments searching for coherent pions are discussed. The ^{12}C (^{12}C, ^{12}C) reaction has been studied at

GANIL at 95 MeV/nucleon giving an upper limit for the cross section (<60nb). Recent measurements performed at SATURNE using the $^{12}C(^3He,t)$ reaction at 2 GeV clearly show a strong indication for coherent pion production and a large shift of the Δ-peak observed in the coherent channel. Both reactions probe the spin-longitudinal response of nuclei. In the intermediate region, near pion production threshold, the distortion effects are less important than at low energy and moreover, the coherence effects might be enhanced. (K.A.) 11 refs., 6 figs.

28738 (PCCF-RI-92-03) **An intranuclear cascade-percolation approach for protons and light fragments production in neon-niobium reactions at 400 and 800 MeV per nucleon.** Montarou, G. (Clermont-Ferrand-2 Univ., 63 - Aubiere (France). Lab. de Physique Corpusculaire); Marroncle, J.; Alard, J.P.; Augerat, J.; Bastid, N.; Charmensat, P.; Dupieux, P.; Fraysse, L.; Parizet, M.J.; Rahmani, A.; Babinet, R.; Cavata, C.; Demoulins, MClermont-Ferrand-2 Univ., 63 - Aubiere (France). Lab. de Physique Corpusculaire. [1992]. 47p. Order Number DE94633329. Source: OSTI; NTIS (US Sales Only); INIS.

Submitted to Phys. Rev., C (US).

The results of intranuclear cascade calculations (ideal gas with two body collisions and no mean-field), complemented by a simple percolation procedure, are compared with experimental data on protons and light nuclear fragments (d, t, ^{3}He and ^{4}He) measured in 400 and 800 MeV/nucleon Ne+Nb collisions using the large solid angle detector DIOGENE. The model reproduces quite well global experimental observables like nuclear fragment multiplicity distributions or production cross-sections, and nuclear fragment to proton ratios. For rapidity distributions the best agreement occurs for peripheral reactions. Transverse momentum analysis confirms once again that the cascade, although being a microscopic approach, gives too small a collective flow. For heavier nuclear fragments conclusions are not so clear. Since the cross-sections are the main ingredients of the detailed treatment of the first stage of the reaction by the intranuclear cascade, such an approach can be very fruitful in order to infer informations on effective nucleon-nucleon cross-sections. (authors). 31 refs., 23 figs., 6 tabs.

28739 (TRI-PP-89-58) **Multi-nucleon pion absorption in the ^{4}He(π^+,ppp)n reaction.** Weber, P. (British Columbia Univ., Vancouver, BC (Canada)); Mcalister, J.; Olszewski, R.; Feltham, A.; Hanna, M.; Johnson, R.R.; Pavan, M.; Ponting, C.; Rozon, F.M.; Sevior, M.; Sossi, V.; Vetterli, D.; Humphrey, D.; Lolos, G.J.; Papandreou, Z.; Ottewell,.TRIUMF, Vancouver, BC (Canada). Jun 1989. 9p. Order Number DE94633333. Source: OSTI; NTIS (US Sales Only); INIS.

Submitted to Physics Letters B.

Three proton emission cross sections for the ^{4}He(π^+,ppp)n reaction were measured at an incident pion kinetic energy of $T_{\pi+}$=165 MeV over a wide angular range in a kinematically complete experiment. The momentum distribution of the undetected neutron as well as energy spectra and angular correlations have been compared with detailed three- and four-body phase space Monte Carlo calculations. The results provide strong evidence that most of the three proton coincidences result from three nucleon absorption. From phase-space integration the total three-nucleon absorption cross section is estimated to be $\sigma^{3N} = 4.5 \pm 1.0$ mb. Although this is a large cross section it does not account for the discrepancy between total absorption cross sections and two-nucleon absorption cross sections. (Author) 4 figs., 2 tabs., 16 refs.

28740 (TRI-PP-89-59) **Pion transfer from hydrogen to deuterium in H_2+D_2 gas mixtures.** Weber, P. (British Columbia Univ., Vancouver, BC (Canada)); Measday, D.F.; Noble, A.J.; Stanislaus, S.; Armstrong, D.S.; Harston, M.R.; Aniol, K.A.; Horvath, D. TRIUMF, Vancouver, BC (Canada). Jun 1989. 21p. Order Number DE94633334. Source: OSTI; NTIS (US Sales Only); INIS.

Submitted to Physical Review A.

The transfer of negative pions from pionic hydrogen to deuterium has been investigated in gas mixtures of H_2 and D_2 as a function of the D_2 concentration. The concentration dependence of the transfer rate was fitted using a phenomenological model with two parameters. For C → ∞ (32±3)% of the pions undergo transfer. The fitted parameters reflect the ratio of pion capture to pion transfer in collisions of pionic hydrogen with protons or deuterons. No pressure dependence for pion transfer was found. (Author) 33 refs., 3 tabs., 7 figs.

28741 (TRI-PP-89-60) **Can the Skyrme model describe low energy s-wave π-nucleon scattering?.** Jennings, B.K. (TRIUMF, Vancouver, BC (Canada)); Maxwell, O.V. TRIUMF, Vancouver, BC (Canada). Jul 1989. 8p. Order Number DE94633335. Source: OSTI; NTIS (US Sales Only); INIS.

Submitted to Nuclear Physics.

S-wave π-nucleon scattering is examined in the Skyrme model using different schemes for quantizing the model and including pion field fluctuations. The phase shifts obtained are sensitive to both the quantization prescription and the ansatz for including fluctuations, but in no case do they agree well with the empirical phase shifts. We conclude that the simple version of the Skyrme model considered here is not suitable for a description of low energy π-nucleon scattering. (Author) 12 refs., 2 figs.

28742 (TRI-PP-89-62) **Transfer of π^- from hydrogen to deuterium in H_2O + D_2O mixtures.** Stanislaus, S. (British Columbia Univ., Vancouver, BC (Canada). Dept. of Physics); Measday, D.F.; Vetterli, D.; Weber, P.; Aniol, K.A.; Harston, M.R.; Armstrong, D.S. TRIUMF, Vancouver, BC (Canada). Jul 1989. 12p. Order Number DE94633336. Source: OSTI; NTIS (US Sales Only); INIS.

Submitted to Physics Letters A.

The transfer of stopping π^- mesons from hydrogen to deuterium has been investigated in mixtures of H_2O+D_2O as a function of D_2O concentration. The concentration dependence of the transfer probability is similar to that observed for the gas mixtures of H_2 and D_2 but slightly more transfer is found for H_2O+D_2O. (Author) 17 refs., 2 tabs., 4 figs.

28743 (TRI-PP-89-66) **Neutral pion photoproduction on the nucleon near threshold.** Nozawa, S. (TRIUMF, Vancouver, BC (Canada)); Lee, T.S.H.; Blankleider, B. TRIUMF, Vancouver, BC (Canada). Jul 1989. 13p. Order Number DE94633286. Source: OSTI; NTIS (US Sales Only); INIS.

Submitted to Physical Review C.

Neutral pion photoproduction on the nucleon near threshold is investigated using a dynamical model. Analytic properties of the final state interaction amplitude in the energy region near π^+n production threshold are examined in detail. It is shown that the commonly used procedure, based on an analytical continuation of the K-matrix to the unphysical region, is not compatible to an approach incorporating full off-energy-shell dynamics. Our calculation indicates that the final state interaction amplitude derived from a dynamical model, could involve large cancellation between the different pion photoproduction mechanisms. This leads to the surprising result that the final state interaction effect due to the intermediate π^0p state can be as important as that due to the π^+n intermediate state. At threshold, we obtain $E_{0+} = -1.92 \times 10^{-3}/m_{\pi+}$. This number is close to the measured value of $E_{0+} = -1.5 \times 10^{-3}/m_{\pi+}$. No violation of the low energy theorem is required to obtain good agreement between the calculated total cross sections and experimental data from threshold to about 400 MeV incident photon energy. (Author) 15 refs., 5 tabs., 8 figs.

28744 (TRI-PP-90-10) **Photon asymmetry in radiative muon capture on calcium.** Virtue, C.J. (British Columbia Univ., Vancouver, BC (Canada). Dept. of Physics); Aniol, K.A.; Entezami, F.E.; Hasinoff, M.D.; Horvath, D.; Roser, H.W.; Robertson, B.C. TRIUMF, Vancouver, BC (Canada). Feb 1990. 21p. Order Number DE94633297. Source: OSTI; NTIS (US Sales Only); INIS.

Submitted to Nuclear Physics A.

The photon asymmetry (α_γ) and partial branching ratio above 57 MeV ($R_{k>57}$) have been measured for radiative muon capture on ^{40}Ca in order to determine the magnitude of the induced-pseudoscalar coupling constant, g_P. Based on 2500 events a value of α_γ $1.32_{-0.47}^{+0.54}$ is obtained from a fit to the photon time spectrum; this implies a value for $g_P < 5.3g_A$. For the first time the asymmetry signal is clearly visible and unconstrained multi-parameter fits reproduce the parameters obtained from the decay electron spectrum. The present results are discussed and compared in detail with previous results. (Author) 46 refs., 2 tabs., 6 figs.

28745 (TRI-PP-90-17) **Theoretical analysis of two-body electrodisintegration of ^{3}He.** van Meijgaard, E. (TRIUMF, Vancouver, BC (Canada)); Tjon, J.A. TRIUMF, Vancouver, BC (Canada). Apr 1990. 40p. Order Number DE94633316. Source: OSTI; NTIS (US Sales Only); INIS.

Submitted to Physical Review C.

The theoretical framework of calculating the electron induced two-body breakup reaction ^{3}He(e,e'p)d at intermediate momentum transfer is described, where nucleonic final-state interactions are exactly accounted for. A nonrelativistic dynamical description is assumed and the half-off-shell scattering state wavefunctions needed for such a calculation are determined by solving the Faddeev equations with Pade approximant technique. Local s-wave spin-dependent potentials are used as two-nucleon input. (Author) 32 refs., 13 figs., 5 tabs.

28746 (TRI-PP-90-18) **^{3}He(e,e'p)^{2}H breakup process.** van Meijgaard, E. (TRIUMF, Vancouver, BC (Canada)); Tjon, J.A. TRIUMF, Vancouver, BC (Canada). Apr 1990. 18p. Order Number DE94633317. Source: OSTI; NTIS (US Sales Only); INIS.

Submitted to Physical Review C.

The coincidence cross section of the electron-induced two-body breakup reaction ^{3}He(e,e'p)d is studied at various kinematic configurations. Nucleonic final-state interactions are treated exactly by solving the Faddeev equations for the relevant scattering states. The essential kinematic parameter in analyzing the results for the various kinematic regions is the missing momentum of the struck nucleon. At missing momenta below 250 MeV/c the s-wave analysis gives an adequate description of the experimental data. At missing momenta beyond 350 MeV/c a pure s-wave analysis is not sufficient. Contributions from the d-state components in the trinucleon wave functions to the disconnected graphs are considered. (Author) 12 refs., 15 figs., tab.

28747 (TRI-PP-91-4) **Radiative muon capture on hydrogen.** Schott, W. (British Columbia Univ., Vancouver, BC (Canada)); Ahmad, S.; Chen, C.Q.; Gumplinger, P.; Hasinoff, M.D.; Larabee, A.J.; Sample, D.G.; Zhang, N.S.; Armstrong, D.S.; Blecher, M.; Serna-Angel, A.; Azuelos, G.; von Egidy, T.; Macdonald, J.A.; PoutisTRIUMF, Vancouver, BC (Canada). Mar 1991. 10p. (CONF-910229--: 6. Lake Louise winter institute (LLWI-6): topical workshop on particle physics - the factory era, Lake Louise (Canada), 17-22 Feb 1991). Order Number DE94633298. Source: OSTI; NTIS (US Sales Only); INIS.

The induced pseudoscalar coupling constant, g_P, of the weak hadronic current can be determined from the measurement of the branching ratio of radiative muon capture (RMC) on hydrogen. This rare process is being investigated in the TRIUMF RMC experiment which is now taking data. This paper describes the experiment and indicates the status of the data analysis. (Author) 8 refs., 7 figs.

28748 (UCRL-ID-117797) **A room temperature, ENDF/B-VI, Mod. 2 cross section library.** Cullen, D.E. Lawrence Livermore National Lab., CA (United States). Jul 1994. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. Order Number DE94016488. Source: OSTI; NTIS; INIS; GPO Dep.

The ENDF/B-VI Library distributed in Sept. 1993 has now been updated to include the most recent modifications; mod. 2. Between the original (mod. 0) and current (mod. 2) libraries, 74 evaluations were updated; no completely new evaluations were added to the library. These evaluations were processed using the most recent version of the ENDF/B Pre-processing codes--PREPRO94. This library contains evaluations for 321 materials (isotopes or naturally occurring elemental mixtures of isotopes). This library contains data for some metastable materials, which are indicated by an "m" at the end of their description. The library contains two evaluations for 26-Fe-56; a standard evaluation extending up to neutron incident energies of 20 MeV, and a second high energy evaluation extending up to 1 GeV; the latter is identified in a table as 26-Fe-56x. The majority of these evaluations are complete, in the sense that they include all cross sections over the energy range 1.0E-5 eV to 20 MeV. However, the following are only partial evaluations that either only contain single reactions and no total cross section: 12-Mg-24, 19-K-41, 22-Ti-46, 22-Ti-47, 22-Ti-48, 22-Ti-50 and 28-Ni-59, or contain no elastic cross section above the resonance region: 18-Ar-40, 42-Mo-92, 42-Mo-98, 42-Mo-100, 49-In-115, 50-Sn-120, 50-Sn-122 and 50-Sn-124.

28749 (UCRL-JC-117461) **Measurement of double differential charged-particle emission cross sections for reactions induced by 26 MeV protons and FKK model analysis.** Watanabe, Y. (Kyushu Univ., Kasuga-Fukuoka (Japan). Dept. of Energy Conversion Engineering); Aoto, A.; Kashimoto, H. Lawrence Livermore National Lab., CA (United States). 1 Jun 1994. 5p. Sponsored by USDOE, Washington, DC (United States);Ministry of Education, Science and Culture (Japan). DOE Contract W-7405-ENG-48. (CONF-940507--35: International conference on nuclear data for science and technology, Gatlinburg, TN (United States), 9-13 May 1994). Order Number DE94016360. Source: OSTI; NTIS; INIS; GPO Dep.

Double differential charged-particle emission cross sections of proton-induced reactions have been measured for ^{nat}C, ^{27}Al, ^{nat}Si, ^{98}Mo, ^{106}Pd, ^{159}Tb and ^{181}Ta at energies around 26 MeV. Several (p,p') and (p,n) data for ^{98}Mo and ^{106}Pd in the incident energy range from 12 to 26 MeV are analysed in terms of the Feshbach-Kerman-Koonin model, in order to study preequilibrium nucleon emission from nucleon-induced reactions.

28750 (UCRL-JC-117462) **The Feshbach-Kerman-Koonin multistep reaction theory and its application to data evaluation.** Hodgson, P.E. (Oxford Univ. (United Kingdom)); Chadwick, M.B. Lawrence Livermore National Lab., CA (United States). 1 Jun 1994. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-940507--34: International conference on nuclear data for science and technology, Gatlinburg, TN (United States), 9-13 May 1994). Order Number DE94016357. Source: OSTI; NTIS; INIS; GPO Dep.

The development of the multistep nuclear reaction theory of Feshbach, Kerman, and Koonin (FKK) is reviewed, with particular attention to recent work. We present methodologies for unambiguously separating multistep direct and multistep compound contributions, and analyze neutron inelastic scattering by ^{93}Nb at 14: MeV to illustrate the approaches. Modification of the FKK theory to include transitions from the multistep direct to the multistep compound chain ("P→Q transitions") is discussed. We also describe developments to the theory in order to calculate inelastic cross sections for incident nucleon energies to 200 MeV. At these high energies multiple preequilibrium emission processes must be included, and a theory for their determination is described and compared with experimental measurements of proton reactions on ^{90}Zr. The usefulness of the FKK theory for a range of nuclear data applications, including intermediate energy reactions of importance in Accelerator Transmutation of Waste, reactions on biologically-important elements for cancer radiation treatment, and reactions of importance in fusion technology, is assessed.

28751 (UCRL-JC-117468) **Benchmark comparisons of evaluated nuclear data files.** Resler, D.A.; Howerton, R.J.; White, R.M. Lawrence Livermore National Lab., CA (United States). May 1994. 3p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-940507--33: International conference on nuclear data for science and technology, Gatlinburg, TN (United States), 9-13 May 1994). Order Number DE94016356. Source: OSTI; NTIS; INIS; GPO Dep.

With the availability and maturity of several evaluated nuclear data files, it is timely to compare the results of integral tests with calculations using these different files. We discuss here our progress in making integral benchmark tests of the following nuclear data files: ENDL-94, ENDF/B-V and -VI, JENDL-3, JEF-2, and BROND-2. The methods used to process these evaluated libraries in a consistent way into applications files for use in Monte Carlo calculations is presented. Using these libraries, we are calculating and comparing to experiment k_{eff} for 68 fast critical assemblies of ^{233,235}U and ^{239}Pu with reflectors of various material and thickness.

6635 Nuclear Mass Ranges

Refer also to citation(s) 28114, 28675, 28680, 28689, 28690, 28698, 28702, 28706, 28707, 28708, 28710, 28711, 28712, 28713, 28719, 28722, 28730, 28731, 28733, 28743, 28749

6636 Radiation Physics

Refer also to citation(s) 27691, 27693, 27694, 28725

28752 (ECN-C–94-015) **Uncertainties in the European activation file EAF-3.1: Subfile EAF/UN-3.1.** Kopecky, J. (Netherlands Energy Research Foundation (ECN), Petten (Netherlands)); Nierop, D.; Forrest, R.A. Netherlands Energy Research Foundation (ECN), Petten (Netherlands). Mar 1994. 30p. Project Number ECN 1.659. Order Number DE94785929. Source: OSTI; NTIS; INIS.

This report contains the description of the work performed to assemble the uncertainty file for the third version of the European Activation File (EAF-3) and the changes implemented in the first revision during 1993 for EAF-3.1. The EAF-3.1 library contains cross-sections for neutron-induced reactions (0-20 MeV energy range) and includes 729 target nuclides with 12,899 reactions with non-zero cross-sections ($>10^{-6}$ b) below 20 MeV. A complementary uncertainty file EAF/UN-3.1 (in ENDF-6/MF33 format) has been generated for all reactions in one-energy group structure for threshold reactions and two-groups for (n,γ) and (n,f) reactions. The error estimates for this file are adopted either from experimental information or from systematic fits of experimental data to simple equations. (orig.)

28753 (FEI–2254) **Spectrum of elementary excitations of liquid potassium.** Zaezzhev, M.V.; Ivanovskij, M.N.; Novikov, A.G.; Savostin, V.V.; Shimkevich, A.L. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk (Russian Federation). Fiziko-Ehnergeticheskij Inst. 1992. 22p. (In Russian). Order Number DE94633340. Source: OSTI; NTIS (US Sales Only); INIS.

From the experimental data on liquid potassium inelastic neutron scattering in the temperrature range of (340-550) K the frequency spectrum of atomic vibrations was derived. Using frequency spectrum a number of other microscopic dynamic characterstics such as velocity autocorrelations, atom mean square displacement, atom vibrations mean square amplitude, interatomic potential force constant, mean square force acting on liquid potassium atom in the force neighbours were obtained. 27 refs., 10 figs.

28754 (FEI–2276) **Isochoric heat capacity and anharmonic effects in liquid potassium.** Zaezzhev, M.V.; Novikov, A.G.; Savostin, V.V. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk (Russian Federation). Fiziko-Ehnergeticheskij Inst. 1992. 17p. (In Russian). Order Number DE94633341. Source: OSTI; NTIS (US Sales Only); INIS.

The data on the frequency spectrum of liquid potassium, obtained from the inelastic neutron scattering experiment in the temperature range 340 K - 550 K, are used to calculate the isochoric heat capacity of this metal to estimate the influence of the anharmonic effects on it and on the interatomic force field of liquid potassium. 5 figs.

28755 (FRCEA-TH–421) **Contributions at the Tripoli Monte Carlo code qualifying on critical experiences and at neutronic interaction study of fissile units.** Nouri, A. CEA Centre d'Etudes de Saclay, 91 - Gif-sur-Yvette (France). Dept. de Mecanique et de Technologie; Paris-11 Univ., 91 - Orsay (France). Jan 1994. 179p. (In French). Order Number DE94633342. Source: OSTI; NTIS (US Sales Only); INIS.

Criticality studies in nuclear fuel cycle are based on Monte Carlo method. These codes use multigroup cross sections which can verify by experimental configurations or by use of reference codes such Tripoli 2. In this Tripoli 2 code nuclear data are errors attached and asked for experimental studies with critical experiences. This is one of the aim of this thesis. To calculate the keff of interacted fissile units we have used the multigroup Monte Carlo code Moret with convergence problems. A new estimator of reactions rates permit to better approximate the neutrons exchange between units and a new importance function has been tested. 2 annexes.

28756 (INIS-RU–377, pp. 39) **Heavy multiple scattering in thick unhomogeneous absorber.** Mayatskij, V.D. AN SSSR, Moscow (Russian Federation); Moskovskij Gosudarstvennyj Univ., Moscow (Russian Federation). Nauchno-Issledovatel'skij Inst. Yadernoj Fiziki. 1993. 148p. (In Russian). (CONF-9305364–: 23. International meeting on the physics of charged particle interaction with crystals, Moscow (Russian Federation), 31 May - 2 jun 1993). In *Thesies of the proceedings of the 23. International meeting on the physics of charged particle interaction with crystals.* Order Number DE94631501. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. HEAVY IONS/multiple scattering; ENERGY SPECTRA; SIMULATION

28757 (LA-SUB–94-99) **Rare event simulation in radiation transport.** Kollman, C. (Stanford Univ., CA (United States)). Los Alamos National Lab., NM (United States); Stanford Univ., CA (United States). Oct 1993. 111p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. Order Number DE94016573. Source: OSTI; NTIS; INIS; GPO Dep.

This dissertation studies methods for estimating extremely small probabilities by Monte Carlo simulation. Problems in radiation transport typically involve estimating very rare events or the expected value of a random variable which is with overwhelming probability equal to zero. These problems often have high dimensional state spaces and irregular geometries so that analytic solutions are not possible. Monte Carlo simulation must be used to estimate the radiation dosage being transported to a particular location. If the area is well shielded the probability of any one particular particle getting through is very small. Because of the large number of particles involved, even a tiny fraction penetrating the shield may represent an unacceptable level of radiation. It therefore becomes critical to be able to accurately estimate this extremely small probability. Importance sampling is a well known technique for improving the efficiency of rare event calculations. Here, a new set of probabilities is used in the simulation runs. The results are multiple by the likelihood ratio between the true and simulated probabilities so as to keep the estimator unbiased. The variance of the resulting estimator is very sensitive to which new set of transition probabilities are chosen. It is shown that a zero variance estimator does exist, but that its computation requires exact knowledge of the solution. A simple random walk with an associated killing model for the scatter of neutrons is introduced. Large deviation results for optimal importance sampling in random walks are extended to the case where killing is present. An adaptive "learning" algorithm for implementing importance sampling is given for more general Markov chain models of neutron scatter. For finite state spaces this algorithm is shown to give with probability one, a sequence of estimates converging exponentially fast to the true solution.

28758 (UCRL-ID–117796) **ENDL type formats for the LLNL Evaluated Atomic Data Library, EADL, for the Evaluated Electron Data Library, EEDL, and for the Evaluated Photon Data Library, EPDL.** Perkins, S.T.; Cullen, D.E. Lawrence Livermore National Lab., CA (United States). Jul 1994. 27p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. Order Number DE94016487. Source: OSTI; NTIS; INIS; GPO Dep.

Over the past five years, Lawrence Livermore National Laboratory has published extensive compilations derived from three of its main atomic data libraries. These are specifically the evaluated atomic relaxation data library, EADL, the evaluated electron interaction data library, EEDL, and the evaluated photon interaction data library, EPDL. All of these libraries span atomic numbers, Z, from 1 to 100. Additionally the particle interaction libraries cover the incident particle energy range from 10 eV to 100 GeV. The purpose of these libraries is to furnish data for particle transport calculations. Thus the files have been released for external distribution in a machine independent characterize format. In a complete coupled electron-photon transport analysis, results from all three of the data files are required. Therefore it is reasonable to discuss the format for all three libraries in the same work; that is the approach taken here. This report is composed of three sections, each section describing one of the libraries. For ease of reading, each section is separate and unique unto itself, including its own table numbers and references. This report will accompany

any request for copies of these evaluated data libraries. This report and these three data libraries are available from the data centers at Brookhaven National Laboratory, RSIC (Oak Ridge National Laboratory), OECD/NEA Data Bank (France), and IAEA (Vienna).

28759 (UCRL-JC–117464) **New nuclear data for high-energy all-particle Monte Carlo transport.** Cox, L.J.; Chadwick, M.B.; Resler, D.A. Lawrence Livermore National Lab., CA (United States). 1 Jun 1994. 3p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-940507–32: International conference on nuclear data for science and technology, Gatlinburg, TN (United States), 9-13 May 1994). Order Number DE94016359. Source: OSTI; NTIS; INIS; GPO Dep.

We are extending the LLNL nuclear data libraries to 250 MeV for neutron and proton interaction with biologically important nuclei; i.e. H, C, N, 0, F, P, and Ca. Because of the large number of reaction channels that open with increasing energies, the data is generated in particle production cross section format with energy-angle correlated distributions for the outgoing particles in the laboratory frame of reference. The new Production Cross Section data Library (PCSL) will be used in PEREGRINE – the new all-particle Monte Carlo transport code being developed at LLNL for dose calculation in radiation therapy planning.

6641 Theory of Electronic Structure of Atoms and Molecules

28760 (FZR–37(prepr.)) **General axial shapes of sodium clusters.** Frauendorf, S. (Forschungszentrum Rossendorf e.V. (FZR), Dresden (Germany). Inst. fuer Kern- und Hadronenphysik); Pashkevich, V.V. Forschungszentrum Rossendorf e.V. (FZR), Dresden (Germany). Inst. fuer Kern- und Hadronenphysik. Apr 1994. 46p. Order Number DE94789721. Source: OSTI; NTIS (US Sales Only); INIS.

The shell correction method is applied to Na clusters to calculate their shapes and binding energies. The equilibrium shapes are calculated minimizing simultaneously five deformation parameters. Strong deviations from spheroidal shape including reflection asymmetric shapes are found. The influence of cluster deformation on the splitting of the dipole resonance and the separation energies is studied and compared with the available experimental data. (orig.)

28761 (UCRL-JC–114326-Rev.1) **Relativistic configuration-interaction calculation of the correlation energies of heliumlike ions: Revision 1.** Cheng, K.T. (Lawrence Livermore National Lab., CA (United States)); Chen, M.H.; Johnson, W.R. Lawrence Livermore National Lab., CA (United States). Apr 1994. 7p. Sponsored by USDOE, Washington, DC (United States);National Science Foundation, Washington, DC (United States). DOE Contract W-7405-ENG-48. Grant PHY-92-04089. (CONF-9309176–1-Rev.1: 2. international conference on computational physics, Beijing (China), 13-17 Sep 1993). Order Number DE94015190. Source: OSTI; NTIS; INIS; GPO Dep.

A new relativistic configuration-interaction (CI) method using B-spline basis functions has been developed to study the correlation energies of two-electron heliumlike ions. Based on the relativistic no-pair Hamiltonian, the CI equation leads to a symmetric eigenvalue problem involving large, dense matrices. Davidson's method is used to obtain the lowest few eigenenergies and eigenfunctions. Results on transition energies and finite structure splittings for heliumlike ions are in very good agreement with experiment throughout the periodic table.

6642 Spectra of Atoms and Molecules and Their Interactions With Photons

Refer also to citation(s) 28771

28762 (DOE/ER/13508–8) **Progress on resonance ionization detection of combustion radicals: [Annual report, June 15, 1993–June 14, 1994].** Cool, T.A. Cornell Univ., Ithaca, NY (United States). School of Applied and Engineering Physics. [1994]. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-86ER13508. Order Number DE94015339. Source: OSTI; NTIS; INIS; GPO Dep.

Selective laser ionization techniques are used in our laboratory for the measurement of concentration profiles of radical intermediates in the combustion of chlorinated hydrocarbon flames. A new ultrasensitive detection technique, made possible with the advent of tunable VUV laser sources, enables the selective near-threshold photoionization of all radical intermediates in premixed hydrocarbon and chlorinated hydrocarbon flames. The progress made on the following three separate experiments during the past year is briefly described in this report. Flame Radical Concentration Measurements with VUV Spectroscopy; observation of hyperfine quantum beats in cyanogen; and the spectroscopy of the ClCO radical.

28763 (DOE/ER/14213–4) **Radiative properties of strongly magnetized plasmas: Progress report, December 1992–November 1993.** Weisheit, J.C. Rice Univ., Houston, TX (United States). Dept. of Space Physics and Astronomy. Nov 1993. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG05-91ER14213. Order Number DE94015487. Source: OSTI; NTIS; INIS; GPO Dep.

The influence of strong magnetic fields on quantum phenomena continues to be a topic of much interest to physicists and astronomers investigating a wide array of problems - the formation of high energy-density plasmas in pulsed power experiments, the crustal structure and radiative properties of neutron stars, transport coefficients of matter irradiated by subpicosecond lasers, the spectroscopy of magnetic white dwarf stars, the quantum Hall effect, etc. The passage of time finds more questions being asked than being answered in this subject, where even the hydrogen atom "paradigm" remains a major challenge. This theoretical program consists of two distinct parts: (1) investigation into the structure and transport properties of many-electron atoms in fields $B > 10^8$ Gauss; and (2) extension of spectral lineshape methods for diagnosing fields in strongly magnetized plasmas. Research during the past year continued to be focused on the first topic, primarily because of the interest and skills of Dr. E.P. Lief, the postdoctoral research associate who was hired to work on the proposal.

28764 (UCRL-JC–117523) **Double ionization in gases driven by optical field ionization using ultrashort laser pulses.** Bolton, P.R.; Fittinghoff, D.N. Lawrence Livermore National Lab., CA (United States). Jun 1994. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-9408121–1: Optical Society of America conference on high field interactions, St. Malo (France), 21-25 Aug 1994). Order Number DE94015137. Source: OSTI; NTIS; GPO Dep.

Rapid optical field ionization (OFI) for atoms and ions is distinguished using ultra-short laser pulses focused to peak fields comparable to Coulomb binding values. This nonperturbative field description facilitates understanding of standard sequential ionization and distinguishes the double (or two-electron ejection) ionization process. Following our discovery of double optical field ionization in He^{+2} at 614 nm we have extended experiments to include helium, neon and argon at an 800 nm wavelength with varying ellipticity. We compare double ionization data with predictions from the semi-classical model by Corkum. New experimental results at 800 nm use 130 femtosecond laser pulses focused to intensities of order 10^{16} W/cm in the extraction region of a 1 meter time-of-flight spectrometer. Gas pressures ranged from 10^{-8} to 10^{-5} torr.

28765 (UCRL-LR–116938) **Experimental and theoretical study of neon-like selenium x-ray laser spectral line profiles.** Koch, J.A. Lawrence Livermore National Lab., CA (United States). 8 Oct 1993. 222p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. Order Number DE94015327. Source: OSTI; NTIS; GPO Dep.

Laser action at soft x-ray wavelengths was first demonstrated in 1985 at Lawrence Livermore National Laboratory. These experiments used two superimposed, line-focused beams of the Novette visible-light laser to heat and explode a thin foil of selenium. The resulting cylindrical expanding selenium plasma had sufficiently high electron temperatures and electron densities to produce population inversions between various 3p and 3s levels in the neon-like ionization state of selenium, predominantly through electron collisional excitation from the closed-shell Ne-like ground state to the upper laser level. This led to the observation of amplification on

several lines near 200 Å, the brightest of which was at 206.38 Å. Laser spectral line profiles were assumed to be dominated by Doppler broadening, based on calculated densities and ion temperatures, but prior to this work the line widths had not been measured. The primary purpose of this research is to investigate the applicability of the Doppler-broadening assumption for the intrinsic line width and for the saturation behavior of the 206.4 Å Ne-like Se x-ray laser. The major component of this work is a series of high-resolution spectroscopic measurements of the 206.4 Å laser line width from Se amplifiers of varying lengths. Shorter amplifiers provide data on the small-signal line width, while the longest amplifiers have sufficient gain to saturate some laser transitions, including the 206.4 Å line, and thus provide data on the saturated line width of this laser. Laser line transfer models are also investigated and developed which predict the amplified line width of Doppler broadened, lifetime broadened and Voigt-profile lasers. Experimental data and the modeling results support the conclusion that an inhomogeneous Doppler broadening model is inadequate for describing the intrinsic line width and the effects of amplification on the line profile of this laser.

6643 Collision Phenomena

28766 (ANL/ER/PP–78774) **Energy dissipation by a longitudinal Raman process.** Fano, U. (Chicago Univ., IL (United States)); Inokuti, Mitio. Argonne National Lab., IL (United States). [1994]. 8p. Sponsored by USDOE, Washington, DC (United States);National Science Foundation, Washington, DC (United States). DOE Contract W-31109-ENG-38. Order Number DE94015027. Source: OSTI; NTIS; INIS; GPO Dep.

The concept of a longitudinal Raman process is introduced to encompass the indirect transmission of energy from slow electrons to nuclei through the reversible polarization of surrounding electrons. Experimental approaches are sought to assess this process quantitatively.

6644 Experimentally Derived Information On Atomic and Molecular Properties

Refer also to citation(s) 28763

6645 Special Atoms and Molecules

28767 (BUDKERINP–93-80) **Order $\alpha^4 R_\infty$ corrections to positronium P levels.** Khriplovich, I.B.; Mil'stein, A.I.; Elkhovskij, A.S. AN SSSR, Novosibirsk (Russian Federation). Inst. Yadernoj Fiziki. 1993. 17p. (IYaF–93-80.). Order Number DE94633368. Source: OSTI; NTIS (US Sales Only); INIS.

The order αR_∞ corrections to positronium P levels are found. 19 refs.

28768 (TRI-PP–89-64) **Search for mixing of muonium (μ^+e^-) and antimuonium (μ^-e^+).** Huber, T.M. (Wyoming Univ., Laramie, WY (United States)); Kunselman, A.R.; Beer, G.A.; Janissen, A.C.; Mason, G.R.; Bowen, T.; Halverson, P.G.; Kendall, K.R.; Fry, C.A.; Heinrich, B.; Myrtle, K.; Marshall, G.M.; Warren, J.B. TRIUMF, Vancouver, BC (Canada). Jul 1989. 30p. Order Number DE94633369. Source: OSTI; NTIS (US Sales Only); INIS.

Submitted to Physical Review C.

A search is described for mixing muonium (μ^+e^-) and antimuonium (μ^-e^+). Thermal muonium was produced by stopping muons in a SiO_2 powder target. As a conversion signature, a μ^- from antimuonium would create ^{184}Ta in an adjacent tungsten foil. The surface layer of the sample was chemically extracted and counted in a low-background germanium spectrometer; no conversion events were observed. The resulting upper limit on the probability that a muonium atom spontaneously converts to antimuonium is 2.0×10^{-6} (90% confidence). This corresponds to a limit of 0.28 G_F on the effective four-fermion coupling constant between muonium and antimuonium. (Author) 52 refs., 2 tabs., 17 figs.

6650 Physics of Condensed Matter

Refer also to citation(s) 28568

28769 (ANL/IPNS/PROC–81937) **Technology and science at a high-power spallation source: Proceedings.** Argonne National Lab., IL (United States). Jan 1994. 115p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-9305339–: Technology and science at a high-power spallation source workshop, Argonne, IL (United States), 13-16 May 1993). Order Number DE94009685. Source: OSTI; NTIS; INIS; GPO Dep.

These proceedings cover many aspects of the usefulness of spallation neutrons. Nine different areas are considered: surfaces and interfaces, engineering, materials science, polymers and complex fluids, chemistry, structural biology, nuclear engineering and radiation effects, condensed matter physics and fundamental physics.

28770 (DOE/ER/45364–T4) **Theory of nonlinear, distortive phenomena in solids: Martensitic, crack, and multiscale structures-phenomenology and physics: Progress summary, 1991–1994.** Sethna, J.P.; Krumhansl, J.A. Cornell Univ., Ithaca, NY (United States). Lab. of Atomic and Solid State Physics. [1994]. 27p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-88ER45364. Order Number DE94015653. Source: OSTI; NTIS; INIS; GPO Dep.

We have identified tweed precursors to martensitic phase transformations as a spin glass phase due to composition variations, and used simulations and exact replica theory predictions to predict diffraction peaks and model phase diagrams, and provide real space data for comparison to transmission electron micrograph images. We have used symmetry principles to derive the crack growth laws for mixed-mode brittle fracture, explaining the results for two-dimensional fracture and deriving the growth laws in three dimensions. We have used recent advances in dynamical critical phenomena to study hysteresis in disordered systems, explaining the return-point-memory effect, predicting distributions for Barkhausen noise, and elucidating the transition from athermal to burst behavior in martensites. From a nonlinear lattice-dynamical model of a first-order transition using simulations, finite-size scaling, and transfer matrix methods, it is shown that heterophase transformation precursors cannot occur in a pure homogeneous system, thus emphasizing the role of disorder in real materials. Full integration of nonlinear Landau-Ginzburg continuum theory with experimental neutron-scattering data and first-principles calculations has been carried out to compute semi-quantitative values of the energy and thickness of twin boundaries in InTl and FePd martensites.

28771 (INIS-RU–377, pp. 109) **Study of sublattice structure in thin HTS-films on orientation dependence of characteristic X-ray excited by protons.** Afrosimov, V.V.; Dzyuba, G.O.; Il'in, R.N.; Panov, M.N.; Sakharov, V.I.; Serenkov, I.T. AN SSSR, Moscow (Russian Federation); Moskovskij Gosudarstvennyj Univ., Moscow (Russian Federation). Nauchno-Issledovatel'skij Inst. Yadernoj Fiziki. 1993. 148p. (In Russian). (CONF-9305364–: 23. International meeting on the physics of charged particle interaction with crystals, Moscow (Russian Federation), 31 May - 2 jun 1993). In *Thesises of the proceedings of the 23. International meeting on the physics of charged particle interaction with crystals.* Order Number DE94631501. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. 2 figs. SUPERCONDUCTING FILMS/microstructure; SUPERCONDUCTING FILMS/titanates; THIN FILMS/microstructure; THIN FILMS/titanates; BACKSCATTERING; BARIUM COMPOUNDS; CRYSTAL LATTICES; CUPRATES; HIGH-TC SUPERCONDUCTORS; HYDROGEN IONS; KEV RANGE 100-1000; MAGNESIUM OXIDES; ORIENTATION; PROTON CHANNELING; STRONTIUM COMPOUNDS; SUBSTRATES; MICROSTRUCTURE; TITANATES; X RADIATION; YTTRIUM COMPOUNDS

28772 (LUTFD2-TFFF–0039-1-160) **Electronic structure of deep levels in silicon. A study of gold, magnesium, and iron centers in silicon.** Thilderkvist, A. L. Lund Univ. (Sweden). Dept. of Solid State Physics. Feb 1994. 47p. Order Number DE94631459. Source: OSTI; NTIS; INIS.

The electronic structure of gold, magnesium and iron related deep centers in silicon is investigated. Their deep and shallow levels are studied by means of fourier transform spectroscopy,

combined with uniaxial stress and Zeeman spectroscopy. The neutral substitutional gold center in silicon is investigated and the center is paramagnetic, S=1/2, with g——≃2.8 and g≃0, and has a static <100> distortion. Reorientation between different equivalent distortions is observed even at 1.9 K. A gold pair center in silicon is studied and several line series, with a zero-phonon line followed by several phonon replicas, are observed. Uniaxial stress and Zeeman results reveal a trigonal symmetry of the center, which together with the high dissociation energy of 1.7 eV suggests that the center consists of two nearest-neighbor substitutional gold atoms. A divacancy model is employed to explain the electronic properties of the center. The interstitial magnesium double donor in silicon in its two charge states Mg^o and Mg^+ is investigated. Deviations in the binding energies of the excited states from those calculated within the effective-mass theory (EMT) are found and explained by a perturbation in the central-cell region. The quadratic Zeeman effect of shallow donors in silicon is analyzed within the framework of the EMT using a numerical approach. The wave functions are calculated in a discrete radial mesh and the Zeeman Hamiltonian has be evaluated for the lowest excited states for fields up to 6 T. The neutral interstitial iron defect in silicon gives rise to two sets of line spectra. The first set arises when an electron is excited to a shallow donor like state where the electron is decoupled from the Fe^+ core which has a $^4T_1$ ground state term. The second set arises when an excited electron of a $_1$ symmetry is coupled by exchange interaction to the core, yielding at $^5T_1$ final state.

28773 (RISO-R–734(EN)) **Ordering phenomena and non-equilibrium properties of lattice gas models.** Fiig, T. Risoe National Lab., Roskilde (Denmark). Physics Dept.; Danmarks Tekniske Hoejskole, Lyngby (Denmark). Mar 1994. 214p. Order Number DE94631460. Source: OSTI; NTIS; INIS.

This report falls within the general field of ordering processes and non-equilibrium properties of lattice gas models. The theory of diffuse scattering of lattice gas models originating from a random distribution of clusters is considered. We obtain relations between the diffuse part of the structure factor $S_{diff}(q)$, the correlation function C(r), and the size distribution of clusters D(n). For a number of distributions we calculate $S_{diff}(q)$ exactly in one dimension, and discuss the possibility for a Lorentzian and a Lorentzian square lineshape to arise. We discuss the two- and three-dimensional oxygen ordering processes in the high T_c superconductor $YBa_2Cu_3O_{6+x}$ based on a simple anisotropic lattice gas model. We calculate the structural phase diagram by Monte Carlo simulation and compared the results with experimental data. The structure factor of the oxygen ordering properties has been calculated in both two and three dimensions by Monte Carlo simulation. We report on results obtained from large scale computations which are in excellent agreement with recent neutron diffraction data. We consider the effect of the diffusive motion of metal-ion dopants on the oxygen ordering properties on $YBa_2Cu_3O_{6+x}$. The stationary properties of metastability in long-range interaction models are studied by application of a constrained transfer matrix (CTM) formalism. The model considered, is an extension of the Blume Capel model to include weak long-range interactions. We show, that the decay rate of the metastable states is closely related to the imaginary part of the equilibrium free-energy density obtained from the CTM formalism. We discuss a class of lattice gas model for dissipative transport in the framework of a Langevin description, which is capable of producing power law spectra for the density fluctuations. We compare with numerical results obtained from simulations of a lattice gas model. (Abstract Truncated)

6651 Nuclear Techniques in Condensed Matter Physics

Refer also to citation(s) 28043, 28158, 28363, 28583, 28753, 28770

28774 (ANL/XFD/CP–82536) **Synchrotron Mossbauer Spectroscopy of powder samples.** Alp, E.E.; Sturhahn, W.; Toellner, T. Argonne National Lab., IL (United States). [1994]. 12p. Sponsored by USDOE, Washington, DC (United States);National Science Foundation, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-940716–1: Conference on synchrotron radiation and materials science, Chester (United Kingdom), 3-8 Jul 1994). Order Number DE94016336. Source: OSTI; NTIS; INIS; GPO Dep.

Synchrotron Mossbauer Spectroscopy, SMS, is an emerging technique that allows fast and accurate determination of hyperfine field parameters similar to conventional Mossbauer spectroscopy with radioactive sources. This new technique, however, is qualitatively different from Mossbauer spectroscopy in terms of equipment, methodology, and analysis to warrant a new name. In this paper, the authors report on isomer shift and quadrupole splitting measurements of Mohr's salt, $Fe(NH_4)_2(SO_4)_2{\cdot}6H_2O$ for demonstration purposes. Theoretical calculations were performed and compared to experiments both in energy and time domain to demonstrate the influence of thickness distribution and preferential alignment of powder samples. Such measurements may prove to be useful when the data collection times are reduced to few seconds in the third generation, undulator based synchrotron radiation sources.

28775 (KFKI–1993-20/E) **Calculation of nuclear resonant scattering spectra of magnetic multilayers.** Deak, L. (Koezponti Fizikai Kutato Intezet, Budapest (Hungary). Research Inst. for Particle and Nuclear Phisics); Bottyan, L.; Nagy, D.L. Hungarian Academy of Sciences, Budapest (Hungary). Central Research Inst. for Physics. Sep 1993. 11p. (CONF-930816–: International conference on the applications of the Moessbauer effect, Vancouver (Canada), 8-14 Aug 1993). Order Number DE94633439. Source: OSTI; NTIS (US Sales Only); INIS.

Calculations of the angle- and time-dependent photon reflectivity of multilayers are presented, using the technique of characteristic matrices. Spectra of $^{56}Fe/^{57}Fe$ and $Cr/^{57}Fe$ multilayers are calculated under various conditions. The parameters of the multilayers are optimized for suitable test samples of reflectometry measurements. (author) 10 refs.; 6 figs.

28776 (LA-UR–94-2574) **Rietveld refinement of magnetic structures from pulsed-neutron-source powder-diffraction data.** Robinson, R.A.; Lawson, A.C.; Larson, A.C.; Von Dreele, R.B.; Goldstone, J.A. Los Alamos National Lab., NM (United States). [1994]. 14p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-9410165–2: Neutron scattering, Sendai (Japan), 11-14 Oct 1994). Order Number DE94016599. Source: OSTI; NTIS; INIS; GPO Dep.

The General Structure Analysis System, GSAS, has recently been modified to include magnetic neutron- scattering cross-sections. Low-temperature diffraction data have been taken on the hexagonal noncollinear antiferromagnet UPdSn on both the HIPD and the NPD powder diffractometers ail LANSCE. The low-resolution data reveal that the magnetic structure has orthorhombic symmetry (magnetic space group $P_cm'c2_1$) between 25K and 40K, and monoclinic symmetry (magnetic space group PC_{1121}) below 25K. The high-resolution data reveal that there are structural distortions with corresponding symmetry changes in each of these phases, to give chemical space groups $Cmc2_1$ and $P2_1$, respectively, while the paramagnetic phase above 40K has space group $P6_3mc$. Using GSAS, we have refined data sets from both diffractometers simultaneously, including both magnetic and structural cross-sections. Magnetoelastic coefficients for the distortions have been extracted and we have determined the sign of the coupling between the structural monoclinicity and the magnetic monoclinicity. The magnetic results from Rietveld refinement are in good agreement with model fitting to the integrated intensities of seven independent magnetic reflections and these, in turn, agree with measurements made on the same sample using the constant-wavelength reactor technique. Our results therefore validate, to some level, both the technique of using spallation sources for complicated magnetic structures and the specifics of the GSAS Rietveld code.

28777 (SAND–94-1619C) **Microcontamination detection using Heavy Ion Backscattering Spectrometry.** Knapp, J.A. (Sandia National Labs., Albuquerque, NM (United States)); Banks, J.C.; Diebold, A.C. Sandia National Labs., Albuquerque, NM (United States). [1994]. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. (CONF-9410132–1: Microcontamination '94, San Jose, CA (United States),

5-6 Oct 1994). Order Number DE94014182. Source: OSTI; NTIS; INIS; GPO Dep.

Heavy Ion Backscattering Spectrometry (HIBS) is a new ion beam analysis tool using heavy, low-energy ions in backscattering mode which can detect very low levels of surface contamination. By taking advantage of the greatly increased scattering cross-section for such ion beams and eliminating unwanted substrate scattering with a thin carbon foil, our research system has achieved a sensitivity ranging from $\sim 5 \times 10^{10}$ atoms/cm^2 for Fe to $\sim 1 \times 10^9$ atoms/cm^2 for Au on Si, without preconcentration. A stand-alone HIBS prototype now under construction in collaboration with SEMATECH is expected to achieve detection limits of $\sim 5 \times 10^9$ atoms/cm^2 for Fe and $\sim 1 \times 10^8$ atoms/cm^2 for Au on Si, again without preconcentration. Since HIBS is standardless and has no matrix effects, it will be useful not only as a standalone tool, but also for benchmarking standards for other tools. This conference is testimony to the importance of controlling contamination in microelectronics manufacturing. By the turn of the century, very large scale integrated circuit processing is expected to require contamination levels well below 1×10^9 atoms/cm^2 in both starting materials and introduced by processing. One of the most sensitive of existing general-purpose tools is Total reflection X-Ray Fluorescence (TXRF), which can detect $\sim 1 \times 10^{10}$ atoms/cm^2 levels of some elements such as Fe and Cu, but for many elements it is limited to 1×10^{12} atoms/cm^2 or worse. TXRF can achieve a sensitivity of 10^8 atoms/cm^2 through the use of synchrotron radiation or via pre-concentration using Vapor Phase Decomposition. HIBS provides an ion beam analysis capability with the potential for providing similar sensitivity at medium Z and higher sensitivity at larger Z, all without pre-concentration or matrix effects.

6653 Interactions Between Beams and Condensed Matter

Refer also to citation(s) 27887, 27905, 27940, 27947, 27950, 28108

28778 (BNL–60605) **Positron annihilation studies of defects in molecular beam epitaxy grown III-V layers.** Umlor, M.T. (Michigan Technological Univ., Houghton, MI (United States). Dept. of Physics); Keeble, D.J.; Asoka-Kumar, P.; Lynn, K.G.; Cooke, P.W. Brookhaven National Lab., Upton, NY (United States). [1994]. 16p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH00016. (CONF-9405198–3: 6. international workshop on slow-positron beam techniques for solids and surfaces (SLOPOS6), Makuhari (Japan), 18-22 May 1994). Order Number DE94015823. Source: OSTI; NTIS; INIS; GPO Dep.

A summary of recent positron annihilation experiments on molecular beam epitaxy (MBE) grown III-V layers is Presented. Variable energy positron beam measurements on $Al_{0.32}Ga_{0.68}As$ undoped and Si doped have been completed. Positron trapping at a open volume defect in $Al_{0.32}Ga_{0.68}$:Si for temperatures from 300 to 25 K in the dark was observed. The positron trap was lost after 1.3 eV illumination at 25K. These results indicate an open volume defect is associated with the local structure of the deep donor state of the DX center. Stability of MBE GaAs to thermal annealing war, investigated over the temperature range of 230 to 700°C, Proximity wafer furnace anneals in flowing argon were used, Samples grown above 450°C were shown to be stable but for sample below this temperature an anneal induced vacancy related defect was produced for anneals between 400 and 500°C. The nature of the defect was shown to be different for material grown at 350 and 230°C. Activation energies of 2.5 eV to 2.3 eV were obtained from isochronal anneal experiments for samples grown at 350 and 230°C, respectively.

28779 (INIS-RU–377) **Thesises of the proceedings of the 23. International meeting on the physics of charged particle interaction with crystals.** Tulinov, A.F.; Khodyrev, V.A. (eds.). AN SSSR, Moscow (Russian Federation); Moskovskij Gosudarstvennyj Univ., Moscow (Russian Federation). Nauchno-Issledovatel'skij Inst. Yadernoj Fiziki. 1993. 148p. (In Russian). (CONF-9305364–: 23. International meeting on the physics of charged particle interaction with crystals, Moscow (Russian Federation), 31 May - 2 jun 1993). Order Number DE94631501. Source: OSTI; NTIS (US Sales Only); INIS.

Reports containing results on theoretical and experimental studies in the area of orientation problems by charged particles interaction with crystals, their application in nuclear physics, solid matter physics for solving technological and material science tasks are presented.

28780 (INIS-RU–377, pp. 15) **Photon radiation at the exit from the crystal during coherent excited ion radiation decay.** Krivosheev, O.Eh.; Pivovarov, Yu.L. AN SSSR, Moscow (Russian Federation); Moskovskij Gosudarstvennyj Univ., Moscow (Russian Federation). Nauchno-Issledovatel'skij Inst. Yadernoj Fiziki. 1993. 148p. (In Russian). (CONF-9305364–: 23. International meeting on the physics of charged particle interaction with crystals, Moscow (Russian Federation), 31 May - 2 jun 1993). In *Thesies of the proceedings of the 23. International meeting on the physics of charged particle interaction with crystals.* Order Number DE94631501. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication 3 refs. GOLD/photon emission; DOPPLER EFFECT; GOLD; MONOCRYSTALS; ORIENTATION; TRANSMISSION

28781 (INIS-RU–377, pp. 24) **To theory of fast ion axis channeling.** Koshcheev, V.P.; Kryuchkov, Yu.Yu.; Kochokmbaev, T.K.; Il'chukov, O.V. AN SSSR, Moscow (Russian Federation); Moskovskij Gosudarstvennyj Univ., Moscow (Russian Federation). Nauchno-Issledovatel'skij Inst. Yadernoj Fiziki. 1993. 148p. (In Russian). (CONF-9305364–: 23. International meeting on the physics of charged particle interaction with crystals, Moscow (Russian Federation), 31 May - 2 jun 1993). In *Thesies of the proceedings of the 23. International meeting on the physics of charged particle interaction with crystals.* Order Number DE94631501. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication 1 ref. MONOCRYSTALS/ion channeling; MONOCRYSTALS; ORIENTATION; STOCHASTIC PROCESSES

28782 (INIS-RU–377, pp. 25) **Channeling analytical model for crystals with chain ordered position.** Pokhil, G.P.; Cherdyntsev, V.V. AN SSSR, Moscow (Russian Federation); Moskovskij Gosudarstvennyj Univ., Moscow (Russian Federation). Nauchno-Issledovatel'skij Inst. Yadernoj Fiziki. 1993. 148p. (In Russian). (CONF-9305364–: 23. International meeting on the physics of charged particle interaction with crystals, Moscow (Russian Federation), 31 May - 2 jun 1993). In *Thesies of the proceedings of the 23. International meeting on the physics of charged particle interaction with crystals.* Order Number DE94631501. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication 5 refs. MONOCRYSTALS/channeling; DIFFUSION; MATHEMATICAL MODELS; MONOCRYSTALS; CHANNELING; ORIENTATION

28783 (INIS-RU–377, pp. 111) **On determination probability of structure changes in $YBa_2Cu_3O_7$ crystal by brustwehr techniques.** Borovik, A.S.; Kovaleva, E.A. AN SSSR, Moscow (Russian Federation); Moskovskij Gosudarstvennyj Univ., Moscow (Russian Federation). Nauchno-Issledovatel'skij Inst. Yadernoj Fiziki. 1993. 148p. (In Russian). (CONF-9305364–: 23. International meeting on the physics of charged particle interaction with crystals, Moscow (Russian Federation), 31 May - 2 jun 1993). In *Thesises of the proceedings of the 23. International meeting on the physics of charged particle interaction with crystals.* Order Number DE94631501. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. 3 refs., 1 fig. HIGH-TC SUPERCONDUCTORS/atomic displacements; ANGULAR DISTRIBUTION; BARIUM COMPOUNDS; COMPUTERIZED SIMULATION; CUPRATES; HELIUM IONS; ION-ATOM COLLISIONS; LATTICE VIBRATIONS; MONOCRYSTALS; ORIENTATION; TRANSITION TEMPERATURE; YTTRIUM COMPOUNDS

28784 (INIS-RU–377, pp. 116) **Effect of intercrystalline fields induced by dissolved impurity atoms on orientation dependence of resonance nuclear reaction yield in crystal systems.** Grinchenko, A.Yu.; Deev, A.S.; Molodkin, V.V.; Svetashov, P.A. AN SSSR, Moscow (Russian Federation); Moskovskij Gosudarstvennyj Univ., Moscow (Russian Federation). Nauchno-Issledovatel'skij Inst. Yadernoj Fiziki. 1993. 148p. (In Russian). (CONF-9305364–: 23. International meeting on the physics of

charged particle interaction with crystals, Moscow (Russian Federation), 31 May - 2 jun 1993). In *Thesises of the proceedings of the 23. International meeting on the physics of charged particle interaction with crystals.* Order Number DE94631501. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. 2 refs., 1 fig. HIGH-TC SUPERCONDUCTORS/crystal field; HIGH-TC SUPERCONDUCTORS/nuclear reaction yield; ALPHA PARTICLES; ALPHA REACTIONS; ANGULAR DISTRIBUTION; GAMMA RADIATION; IMPURITIES; MONTE CARLO METHOD; NIOBIUM; NITROGEN; NITROGEN 14; ORIENTATION; OXYGEN 16; PROTON REACTIONS

28785 (MPI-PhE–94-10) **A simplistic model for reverse annealing in irradiated silicon.** Lutz, G. (Max-Planck-Institut fuer Physik, Muenchen (Germany). Halbleiterlabor). Max-Planck-Institut fuer Physik, Muenchen (Germany). Werner-Heisenberg-Institut. Mar 1994. 17p. Order Number DE94789666. Source: OSTI; NTIS (US Sales Only); INIS.

Based on the experimental results of systematic studies on radiation damage by several groups, a model is presented which is able to explain some puzzles as the apparent absence of type inversion near the silicon surface of strongly irradiated detectors and the continuing functioning of n-type silicon detectors after type inversion. As a consequence of this model a new method for suppressing reverse annealing is proposed. This method at the same time would strongly reduce doping changes due to irradiation and also diminish the reverse bias current. It thus could significantly increase the radiation hardness of silicon detectors. (orig.)

6654 Quantum Physics Aspects of Condensed Matter

Refer also to citation(s) 27995

28786 (LA-UR–94-2388) **Pairing on small clusters in the Peierls-Hubbard model: Implications for C_{60}.** Gammel, J.T. (Los Alamos National Lab., NM (United States). Theoretical Div.); Ung, K.C.; Mazumdar, S. Los Alamos National Lab., NM (United States). [1994]. 7p. Sponsored by USDOE, Washington, DC (United States);National Science Foundation, Washington, DC (United States). DOE Contract W-7405-ENG-36. Grant ECS-89-11960. (CONF-940529–21: 185. Electrochemical Society meeting, San Francisco, CA (United States), 22-27 May 1994). Order Number DE94016284. Source: OSTI; NTIS; INIS; GPO Dep.

Inclusion of electron-phonon interactions can substantially modify the conclusions about pairing obtained from models including only electron-electron interactions. The authors study pairing within the Peierls-Hubbard model for electron- and hole-doped analogs of C_{60} accessible to exact diagonalization techniques (cube, truncated tetrahedron, etc.), and discuss the extrapolation from these small system calculations to C_{60}.

665410 Superconductivity

Refer also to citation(s) 27859, 27860, 27897, 27927, 27932, 28335, 28770, 28782, 28861

28787 (ANL/ET/CP–82304) **Mechanical properties of high-temperature superconducting wires.** Goretta, K.C. (Argonne National Lab., IL (United States)); Cluff, J.A.; Joo, J.; Lanagan, M.T.; Singh, J.P.; Vasanthamohan, N.; Xin, Y.; Wong, K.W. Argonne National Lab., IL (United States). Jun 1994. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-940627–2: 4. international conference and exhibition of the World Congress on Superconductivity, Orlando, FL (United States), 27 Jun - 1 jul 1994). Order Number DE94015089. Source: OSTI; NTIS; GPO Dep.

Bending strength, fracture toughness, and elastic modulus data were acquired for $YBa_2Cu_3O_x$, $Bi_2Sr_2CaCu_2O_x$, $(Bi,Pb)_2Sr_2Ca_2Cu_3O_x$, and $Tl_2Ba_2Ca_2Cu_3O_x$ bars. These data and thermal expansion coefficients strongly suggest that the maximum tensile strain without fracture possible in bulk tapes or wires is ≈0.2%. In Ag-clad conductors, residual stresses will be of limited benefit, but fractures produced by larger strains can be accommodated by shunting of current through the Ag.

28788 (ANL/MCS/PP–75712) **Dynamics on the attractor for the complex Ginzburg-Landau equation.** Takac, P. (Vanderbilt Univ., Nashville, TN (United States). Dept. of Mathematics). Argonne National Lab., IL (United States). [1994]. 51p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. Order Number DE94016902. Source: OSTI; NTIS; GPO Dep.

We present a numerical study of the large-time asymptotic behavior of solutions to the one-dimensional complex Ginzburg-Landau equation with periodic boundary conditions. Our parameters belong to the Benjamin-Feir unstable region. Our solutions start near a pure-mode rotating wave that is stable under sideband perturbations for the Reynolds number R ranging over an interval (R_{sub},R_{sup}). We find sub- and super-critical bifurcations from this stable rotating wave to a stable 2-torus as the parameter R is decreased or increased past the critical value R_{sub} or R_{sup}. As $R > R_{sup}$ further increases, we observe a variety of dynamical phenomena, such as a local attractor consisting of three unstable manifolds of periodic orbits or 2-tori cyclically connected by manifolds of connection orbits. We compare our numerical simulations to both rigorous mathematical results and experimental observations for binary fluid mixtures.

28789 (ANL/MCS/PP–78203) **Vortex configurations in high-T_c superconducting films.** Kaper, H.G.; Kwong, M.K. Argonne National Lab., IL (United States). 23 Nov 1992. 27p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. Order Number DE94016374. Source: OSTI; NTIS; GPO Dep.

This article addresses the Ginzburg-Landau (GL) model for high-temperature superconductivity in thin films (two-dimensional periodic domains). A new gauge is defined to reduce the coupling between the equations for the nonzero components of the vector potential. The GL equations are written in a novel form by means of continuous link variables; this form is symmetric and has particular advantages for numerical analysis. The continuous GL model is approximated by a discrete model, which is shown to be second-order accurate. Two methods are used for the numerical solution of the discrete model - a modified Newton's method, in combination with a sweeping algorithm for the solution of the linear system, and a time-like integration method based on gradient flow. Numerical experiments demonstrate that the discrete GL model leads to asymmetric solutions in the plane; symmetry is recovered only in the limit as the mesh size goes to zero. The results of computational experiments to find the upper critical field and establish an empirical power law for vortex interactions are given.

28790 (CEA-CONF–11696) **Explicit solutions of the generalized Ginzburg-Landau equation from linear systems.** Musette, M. (Vrije Univ., Brussels (Belgium)); Conte, R. CEA Centre d'Etudes de Saclay, 91 - Gif-sur-Yvette (France). Dept. de Recherche sur l'Etat Condense, les Atomes et les Molecules. 23 Nov 1992. 9p. (CONF-9207241–: Conference on nonlinear evolution equations and dynamical systems, Dubna (Russian Federation), 6-17 Jul 1992). Order Number DE94633493. Source: OSTI; NTIS (US Sales Only); INIS.

The singularity structure of the complex one-dimensional Ginzburg-Landau equation in the complex (x,t) plane shows the inadequacy of the representations (Re A,Im A), (A,A-bar) for A, even in the nonlinear Schroedinger (NLS) limit. The elementary representation consists of two fields (Z,Θ), respectively complex and real, uniquely defined by an explicit expression for Θ and A. The four famous solutions of Nozaki and Bekki are then represented by two linear partial differential equations with constant coefficients and a finite set of constants. It is also shown how the invariance by parity on A increases the class of expected solutions. (authors) 24 refs.

28791 (CONF-940278–) **HTS Wire Development Workshop: Proceedings.** Oak Ridge National Lab., TN (United States). Jul 1994. 507p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From HTS wire development workshop; St. Petersburg, FL (United States); 16-17 Feb 1994. Order Number DE94015650. Source: OSTI; NTIS; GPO Dep.

The 1994 High-Temperature Superconducting Wire Development Workshop was held on February 16–17 at the St. Petersburg Hilton and Towers in St. Petersburg, Florida. The meeting was hosted by

Florida Power Corporation and sponsored by the US Department of Energy's Superconductivity Program for Electric Power Systems. The meeting focused on recent high-temperature superconducting wire development activities in the Department of Energy's Superconductivity Systems program. The meeting opened with a general discussion on the needs and benefits of superconductivity from a utility perspective, the US global competitiveness position, and an outlook on the overall prospects of wire development. The meeting then focused on four important technology areas: Wire characterization: issues and needs; technology for overcoming barriers: weak links and flux pinning; manufacturing issues for long wire lengths; and physical properties of HTS coils. Following in-depth presentations, working groups were formed in each technology area to discuss the most important current research and development issues. The working groups identified research areas that have the potential for greatly enhancing the wire development effort. These areas are discussed in the summary reports from each of the working groups. This document is a compilation of the workshop proceedings including all general session presentations and summary reports from the working groups.

28792 (FRCEA-TH–416) **A contribution to the study of high Tc superconducting coatings and multi-layer coatings electromagnetic properties: surface impedance measurement with a tunnel diode oscillator.** Omari, A. CEA Centre d'Etudes de Grenoble, 38 (France). Dept. de Recherche Fondamentale sur la Matiere Condensee; Grenoble-1 Univ., 38 (France). 21 Oct 1993. 125p. (In French). Order Number DE94633494. Source: OSTI; NTIS (US Sales Only); INIS.

A surface impedance measurement system for conducting or superconducting thin films have been developed through the electromagnetic coupling of these films to a tunnel diode oscillator. The electromagnetic response of $YBa_2\ Cu_3\ O_{7-\delta}$ superconducting films and of id/$La_{2-x}\ Sr_x\ Cu\ O_4$ multilayers, is studied, showing the 'granular' type of these materials. The intergranular coupling is of the SIS type for the films and of the SNS type for the multilayers. A resistance increase is observed when the temperature decreases in the superconducting phase. 120 p., 45 fig., 60 ref.

28793 (FRCEA-TH–417) **The phase diagram, under hydrostatic pressure, of the heavy fermion superconductor Ce Cu_2 Si_2.** Thomas, F. CEA Centre d'Etudes de Grenoble, 38 (France). Dept. de Recherche Fondamentale sur la Matiere Condensee; Grenoble-1 Univ., 38 (France). 27 Oct 1993. 102p. (In French). Order Number DE94633495. Source: OSTI; NTIS (US Sales Only); INIS.

The pressure dependence of the superconducting transition temperature of the heavy fermion compound is re-examined. Measurements are reported in the 0-10 GPa range with special attention paid to the achievement of hydrostatic conditions: natural diamond anvil cells, helium as a pressure transmitting medium and ruby fluorescence for measuring pressure. The geometry for measuring Tc using ac susceptibility in a ^{3} He refrigerator is described. The main properties of Ce Cu_2 Si_2 are discussed. The phase diagram of Tc vs p between 0 and 10 GPa is presented together with a theoretical explanation of the behaviour. There are two characteristic pressures (3.1 and 7.6 GPa) where there are abrupt changes in the slope of Tc(p). 32 fig., 86 ref.

28794 (LA-UR–94-1614) **Fabrication of biaxially oriented YBCO on (00ℓ) biaxially oriented yttria-stabilized-zirconia on polycrystalline substrates.** Arendt, P. (and others); Foltyn, S.; Wu, Xin Di. Los Alamos National Lab., NM (United States). [1994]. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-9404189–1: Materials Research Society (MRS) meeting, Pittsburgh, PA (United States), Apr 1994). Order Number DE94014808. Source: OSTI; NTIS; GPO Dep.

Ion-assisted, ion-beam sputter deposition is used to obtain (00l) biaxially oriented films of cubic yttria-stabilized-zirconia (YSZ) on polycrystalline metal substrates. Yttrium-barium-copper-oxide (YBCO) is then heteroepitaxially-pulse-laser deposited onto the YSZ. Phi scans of the films show the full-width-half maxima of the YSZ (202) and the YBCO(103) reflections to be 14° and 10° respectively. Our best dc transport critical current density measurement for the YBCO is 800,000 A/cm^2 at 75K and 0T. At 75K, the total dc transport current in a 1 cm wide YBCO film is 23 A.

28795 (LBL–35022) **Low-frequency noise in high-$T_c$superconductor Josephson junctions, SQUIDs, and magnetometers.** Miklich, A.H. Lawrence Berkeley Lab., CA (United States). May 1994. 122p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00098. Order Number DE94016873. Source: OSTI; NTIS; GPO Dep.

Design and performance of high-T_c dc superconducting quantum interference devices (SQUEDs), junctions that comprise them, and magnetometers made from them are described, with attention to sources of 1/f noise. Biepitaxial junctions are found to have large levels of critical current fluctuations which make them unsuitable for low-noise SQUIDS; this suggests a poorly connected interface at the grain boundary junction. SQUIDs from bicrystal junctions have levels of critical current noise controllable using bias current reversal techniques which leave the noise white down to frequencies of a few Hz. A SQUID with an energy resolution of 1.5×10^{-30} J Hz^{-1} at 1 Hz is reported. Magnetometers in which a (9 mm)^2 pickup loop is directly coupled to a SQUID body have achieved field resolutions of 93 fT $Hz^{-1/2}$ down to frequencies below I Hz, improving to 39 fT $Hz^{-1/2}$ at 1 Hz with the addition of a 50mm-diameter single-turn flux transformer. Poor coupling to pickup loop makes it difficult to satisfy competing goals of high field resolution and small detector size necessary for multichannel biomagnetic imaging. Improved coupling is demonstrated by the use of multiturn-input-coil flux transformers, and a resolution of 35 fT $Hz^{-1/2}$ in the white noise region is reported with a (10 mm)^2 pickup loop. However, additional 1/f noise from processed multilayer structures in the transformer limits the resolution at 1 Hz to 114 fT $Hz^{-1/2}$. High-T_c SQUIDs exhibit additional 1/f noise when cooled in a nonzero static magnetic field because of additional flux vortices trapped in the film, with the noise power at 1 Hz typically increasing by a factor of 10–20 in a field of 0.05mT (0.5 G). Finally, a SQUID-based voltmeter with a resolution of 9.2 pV.$Hz^{-1/2}$ at 10 Hz (24 pV $Hz^{-1/2}$ at 1 Hz) is described.

28796 (LBL–35671) **Resonant tunneling in small current-biased Josephson Junctions.** Schmidt, J.M. Lawrence Berkeley Lab., CA (United States). ©May 1994. 163p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00098. Order Number DE94016875. Source: OSTI; NTIS; GPO Dep.

Effects of resonant tunneling between bound quantum states of a current-biased Josephson tunnel junction is studied both theoretically and experimentally. Several effects are predicted to arise from resonant tunneling, including a series of voltage peaks along the supercurrent branch of the current-voltage characteristic, and enhanced rate of escape from zero voltage state to voltage state at particular values of bias current. A model is developed to estimate magnitude and duration of voltage peaks, and to estimate enhancement of the escape rate, which appears as peaks in the rate as a function of bias current. An experimental investigation was carried out in an attempt to observe these predicted peaks in the escape rate distribution in a current-biased DC SQUID, which is shown to be dynamically equivalent to a Josephson junction with adjustable critical current. Electrical contact to each SQUID (fabricated from aluminium) was made through high resistance thin film leads located on the substrate. These resistors provided a high impedance at the plasma frequency which is for the isolation of the SQUID from its electromagnetic environment. Measurements were carried out on a dilution refrigerator at temperatures as low as 19 mK. No evidence was found for resonant tunneling; this is attributed to effective temperatures of hundreds of millikelvin. The behavior is well explained by a heating model where the high effective temperatures are generated by ohmic heating of the electron gas of the isolation resistors, which decouples from the phonon system (hot electron effect). The prospects for further theoretical and experimental research are discussed.

28797 (NUTEK-NYEL–94-1) **High temperature superconductors fabrication, characteristics and applications.** Claeson, T. (Chalmers Univ. of Technology, Gothenburg (Sweden). Inst. of Physics). Swedish National Board for Industrial and Technical Development (NUTEK), Stockholm (Sweden). [1994]. 6p. (In

Swedish). Project NUTEK 616-065. Order Number DE94783407. Source: OSTI; NTIS.

With swedish abstract.

Laser deposition has been used to manufacture superconducting $YBa_2Cu_3O_7$ thin films of very high quality. Critical temperatures of 92 K, critical currents of $5x10^6$ A/cm^2 at 77 K, and microwave surface resistances of 85 $\mu\Omega$ at 4.2 K and 10 GHz have been achieved. Trilayers with an insulation resistivity of $2x10^9$ Ωcm at 77 K have been made. The insulating intermediate layer in these trilayers consisted of a multilayer built up from a number of $SrTiO_3$ and $PrGaO_3$ films. The microstructure of the intermediate layer was considerably improved when a multilayer was used. The critical current of an ultrathin (45 Aa) $YBa_2Cu_3O_{7-x}$ film has been modulated by an electrostatic field. A modulation of 2.4% was observed at 40 K when $\pm$80 V was applied in the gate of a device of field effect type.

6655 Direct Energy Conversion

28798 (IPP–6/321) **Energy methods in dissipative magnetohydrodynamics.** Tasso, H. Max-Planck-Institut fuer Plasmaphysik, Garching (Germany). Apr 1994. 22p. Order Number DE94789719. Source: OSTI; NTIS (US Sales Only); INIS.

A brief summary of energy methods for linear stability in dissipative magnetohydrodynamics is given. In this case, the methods are equally efficient for fixed and free boundary problems. Linear asymptotic stability has implications in nonlinear stability, at least for a modest but finite level of perturbations. Sufficient conditions for nonlinear stability of dissipative magneto-hydrodynamics flows are obtained and applied to the time dependent magnetized Couette flow. The fluid has a plate as boundary and nonlinear stability is unconditional. The range of stable Reynolds numbers is rather modest i.e. of the order of $2\pi^2 \approx 20$. Nonlinear stability of force free fields can be treated very successfully for all values of dissipation and all levels of perturbations. It requires, however, the presence of perfectly conducting fixed boundaries. Finally, a special inertia-caused Hopf bifurcation is identified and illustrated by an appropriate example. (orig.)

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28799 (ORNL–6714) **Fusion Energy Division progress report, 1 January 1990–31 December 1991.** Sheffield, J.; Baker, C.C.; Saltmarsh, M.J. Oak Ridge National Lab., TN (United States). Mar 1994. 310p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE94015516. Source: OSTI; NTIS; INIS; GPO Dep.

The Fusion Program of the Oak Ridge National Laboratory (ORNL), a major part of the national fusion program, encompasses nearly all areas of magnetic fusion research. The program is directed toward the development of fusion as an economical and environmentally attractive energy source for the future. The program involves staff from ORNL, Martin Marietta Energy systems, Inc., private industry, the academic community, and other fusion laboratories, in the US and abroad. Achievements resulting from this collaboration are documented in this report, which is issued as the progress report of the ORNL Fusion Energy Division; it also contains information from components for the Fusion Program that are external to the division (about 15% of the program effort). The areas addressed by the Fusion Program include the following: experimental and theoretical research on magnetic confinement concepts; engineering and physics of existing and planned devices, including remote handling; development and testing of diagnostic tools and techniques in support of experiments; assembly and distribution to the fusion community of databases on atomic physics and radiation effects; development and testing of technologies for heating and fueling fusion plasmas; development and testing of superconducting magnets for containing fusion plasmas; development and testing of materials for fusion devices; and exploration of opportunities to apply the unique skills, technology, and techniques developed in the course of this work to other areas (about 15% of the Division's activities). Highlights from program activities during 1990 and 1991 are presented.

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Refer also to citation(s) 28070, 28102, 28797, 28851, 28852, 28863, 28864

28800 (ANL/TD/CP–82096) **Plasma disruption modeling and simulation.** Hassanein, A. Argonne National Lab., IL (United States). Jun 1994. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-940630–34: 11. topical meeting on the technology of fusion energy, New Orleans, LA (United States), 19-24 Jun 1994). Order Number DE94015095. Source: OSTI; NTIS; INIS; GPO Dep.

Disruptions in tokamak reactors are considered a limiting factor to successful operation and a reliable design. The behavior of plasma-facing components during a disruption is critical to the overall integrity of the reactor. Erosion of plasma facing-material (PFM) surfaces due to thermal energy dump during the disruption can severely limit the lifetime of these components and thus diminish the economic feasibility of the reactor.Initially, the incident plasma particles will deposit their energy directly on the PFM surface, heating it to a very high temperature where ablation occurs. Models for plasma-material interactions have been developed and used to predict material thermal evolution during the disruption. Within a few microseconds after the start of the disruption, enough material is vaporized to intercept most of the incoming plasma particles. Models for plasma-vapor interactions are necessary to predict vapor cloud expansion and hydrodynamics. Continuous heating of the vapor cloud above the material surface by the incident plasma particles will excite, ionize, and cause vapor atoms to emit thermal radiation. Accurate models for radiation transport in the vapor are essential for calculating the net radiated flux to the material surface which determines the final erosion thickness and consequently component lifetime. A comprehensive model that takes into account various stages of plasma-material interaction has been developed and used to predict erosion rates during reactor disruption, as well during induced disruption in laboratory experiments. Differences between various simulation experiments and reactor conditions are discussed. A two-dimensional radiation transport model has been developed to particularly simulate the effect of small test samples used in laboratory disruption experiments.

28801 (CONF-920362–49) **Alpha particle kinetics in ignited fusion plasmas: Design applications for a CO_2 laser Thomson scattering experiment: Final report, August 1989–December 1993.** Bennett, C.A. North Carolina Univ., Asheville, NC (United States). Dept. of Physics. May 1994. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG05-89ER53288. From 9. topical conference on high-temperature plasma diagnostics; Santa Fe, NM (United States); 15-19 Mar 1992. Order Number DE94016297. Source: OSTI; NTIS; INIS; GPO Dep.

Technical achievements during the initial budget phase of this study consists of work accomplished under the following categories: (a) Hot Cell Notch Filter; and (b) System Integration. In the two week period just prior to the 1993 shutdown of ATF, the authors were able to make the planned scattering measurement. The experiment was a complete success, and the feasibility of the approach was unambiguously demonstrated. The measurements have been reported in a separate article.

28802 (DOE/ER/53194–4) **Nonlinear magnetohydrodynamics: Progress report, July 1, 1993–June 30, 1994.** Montgomery, D.C. Dartmouth Coll., Hanover, NH (United States). 30 Jul 1994. 13p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-85ER53194. Order Number DE94016223. Source: OSTI; NTIS; INIS; GPO Dep.

Work has continued to focus on resistive, viscous, magnetohydrodynamic (MHD) steady states that model tokamak configurations. Recent emphasis has been on the subject of plasma rotation, and the stabilizing effects it has on the kind of MHD activity that results when current thresholds are exceeded in non-rotating configurations. The author believes that relatively superficial consequences of the effects of rotation (e.g., the "velocity shear layer," which must result when any fluid of whatever nature is rotated in the presence of a material boundary) have been assigned causative effects that do not belong to them, in the

presently-dominant perspective on the subject. Output from the author's three-dimensional spectral-method numerical code has shown how rotation may be made to suppress helical deformations of the current channel and paired helical vortices in a supercritical magnetofluid column. A velocity "shear layer" results if and when there is wall friction. The role of ion parallel viscosity (rather than shear viscosity) in determining stability boundaries in current-carrying magnetofluids is being investigated. A lattice-Boltzmann equation method of computing three-dimensional magnetohydrodynamic toroidal effects is under consideration.

28803 (DOE/ER/53212–241) **Lower-hybrid poloidal current drive for fluctuation reduction in a reversed field pinch.** Uchimoto, E. (Univ. of Wisconsin, Madison, WI (United States)); Cekic, M.; Harvey, R.W.; Litwin, C.; Prager, S.C.; Sarff, J.S.; Sovinec, C.R. Wisconsin Univ., Madison, WI (United States). Plasma Physics Research. Jun 1994. 13p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-85ER53212. Order Number DE94015534. Source: OSTI; NTIS; INIS; GPO Dep.

Current drive using the lower-hybrid slow wave is shown to be a promising candidate for improving confinement properties of a reversed field pinch (RFP). Ray-tracing calculations indicate that the wave will make a few poloidal turns while spiraling radially into a target zone inside the reversal layer. The poloidal antenna wavelength of the lower hybrid wave can be chosen so that efficient parallel current drive will occur mostly in the poloidal direction in this outer region. Three-dimensional resistive magnetohydrodynamic (MHD) computation demonstrates that an additive poloidal current in this region will reduce the magnetic fluctuations and magnetic stochasticity.

28804 (DOE/ER/54157–3) **Global confinement analysis: Final report, May 1, 1992–April 31, 1994.** Riedel, K.S. New York Univ., NY (United States). Courant Inst. of Mathematical Sciences. 22 Jul 1994. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-92ER54157. Order Number DE94016820. Source: OSTI; NTIS; INIS; GPO Dep.

A brief description of the task: (1) Analyze confinement databases to development predictions for ITER, and identify and quantify major sources of continement uncertainty. (2) Determine the parametric dependencies of the temperature and density profiles for reactor relevant plasmas.

28805 (DOE/ER/54160–1-Vol.3, pp. 1984-1989) **Plasma dynamics and hotspots studies from a plasma focus device.** Tzeng, C.C. (Institute of Nuclear Energy Research, Lung-Tan (China)); Yeh, C.K.; Yu, Y.J.; Kuo, Y.Y.; Wen, M.; Hou, W.S.; Yeh, T.R. Maryland Univ., College Park, MD (United States). [1992]. (CONF-920515–Vol.3: 9. international conference on high power particle beams, Washington, DC (United States), 25-29 May 1992). In *Beams 92: Proceedings: Volume 3, Microwaves, Free electron lasers, Advanced accelerators, Applications, and Plasma discharges.* 681p. Order Number DE94014785. Source: OSTI; NTIS; INIS.

The dynamics of the plasma (Ne, Ar) evolution and hotspots formation has been studied by a PIN detector, a time-resolved and time-integrated MCP soft X-ray pinhole camera, fast optical camera systems and a N_2-laser interferometry. Fast streak and framing photos reveal two well-defined compressions with ~60 ns time separation during the plasma evolution. Consequently the soft X-ray emission which was monitored by MCP camera and PIN detector is observed to be mainly coming from the first compression. For both Ne and Ar gases, maximum electron densities of $>5x10^{19}$ cm^{-3} are obtained ~10 ns after the onset of the X-ray emission. The maximum electron densities of the hot spots estimated from the Bennet's relation are about 10^{21} cm^{-3} for Argon plasma.

28806 (DOE/ER/54160–1-Vol.3, pp. 1990-1995) **Deuterium-fiber-initiated Z-pinches: Simulation compared to experiment.** Sheehey, P. (Univ. of California, Los Angeles, CA (United States)); Lindemuth, I.R.; Lovberg, R.H.; Riley, R.A. Jr. Maryland Univ., College Park, MD (United States). [1992]. (CONF-920515–Vol.3: 9. international conference on high power particle beams, Washington, DC (United States), 25-29 May 1992). In *Beams 92: Proceedings: Volume 3, Microwaves, Free electron lasers, Advanced accelerators, Applications, and Plasma discharges.* 681p. Order Number DE94014785. Source: OSTI; NTIS; INIS.

Deuterium-fiber-initiated Z-pinch experiments have been simulated using a two-dimensional resistive magnetohydrodynamic model which includes many important experimental details, such as "cold-start" initial conditions, thermal conduction, radiation, actual discharge current vs. time, and grids of sufficient size and resolution to allow realistic development of the plasma. When the fiber becomes fully ionized (at a time depending on voltage ramp and fiber thickness), the simulations show rapidly developing m=0 instabilities which drive intense non-uniform heating and rapid expansion of the plasma column. Diagnostics generated from the simulation results, such as shadowgrams and interferograms, are in good agreement with experiment. Comparison of simulation-generated diagnostics with those from early experiments of this type suggests that shadowgram images of the plasma were misleading indicators of the stability and rate of expansion of the plasma column. Terms often left out of the fluid model, such as the Hall term and the viscous stress tensor, may be significant in the Z-pinch. Progress will be reported on the addition of such terms to the simulation.

28807 (DOE/ER/54160–1-Vol.3, pp. 1996-2001) **Radiative collapse of a dense plasma.** Rahman, H.U. (Univ. of California, Riverside, CA (United States)); Rostoker, N.; Wessel, F.J. Maryland Univ., College Park, MD (United States). [1992]. (CONF-920515–Vol.3: 9. international conference on high power particle beams, Washington, DC (United States), 25-29 May 1992). In *Beams 92: Proceedings: Volume 3, Microwaves, Free electron lasers, Advanced accelerators, Applications, and Plasma discharges.* 681p. Order Number DE94014785. Source: OSTI; NTIS; INIS.

Radiative collapse of a dense θ pinch plasma driven by an annular Z-pinch is considered. A cryogenic fiber is coaxially located within the annular gas jet Z-pinch. The imploding Z-pinch traps an applied axial magnetic field and conserves the flux. The axial magnetic field increases due to the compression and has attained values in excess of 20 M-Gauss. If a fiber is placed on axis an azimuthal θ-current is induced with a rise time that is an order of magnitude shorter than the rise time of the Z-pinch current. Such a rise time could not be achieved with a simple Z-pinch because of the larger inductance of the axial fiber-plasma. The implosion transfers the kinetic energy of the Z-pinch to the magnetic field and then to the θ-pinch. The terminal particle pressure of the θ-pinch exceeds the magnetic pressure so that the pinch then expands - the only confinement is inertial. It is possible to make an intense neutron source e.g. a yield of 4 x 10^{15} neutron/cm with a Z-pinch current of 10 M-Amperes; but break-even would require much larger currents. To reach break-even and beyond with a reasonable Z-pinch current, the authors propose to make use of radiative collapse. By seeding the cryogenic Hydrogen-like fiber with higher Z-material, the radiation would be substantially increased and the θ-pinch would cool and collapse thereby increasing the density. For example, a density of order 10^{24} cm^{-3} has been observed with a seeded plasma focus. The confinement time is determined by the temperature and would not decrease. Thus $n\tau$ ~10^{14} could be reached with a confinement time of .1 nanosec.

28808 (DOE/ER/54160–1-Vol.3, pp. 2002-2007) **Gold Z-pinches on SATURN.** Spielman, R.B. (Sandia National Labs., Albuquerque, NM (United States)). Maryland Univ., College Park, MD (United States). [1992]. (CONF-920515–Vol.3: 9. international conference on high power particle beams, Washington, DC (United States), 25-29 May 1992). In *Beams 92: Proceedings: Volume 3, Microwaves, Free electron lasers, Advanced accelerators, Applications, and Plasma discharges.* 681p. Order Number DE94014785. Source: OSTI; NTIS; INIS.

The author shows data from gold z-pinch implosions on the Sandia Saturn accelerator at current levels of 10 MA. The x-ray yields and powers from these experiments have reached 600 kJ and 20 TW, respectively. These data differ dramatically from identical experiments using materials such as aluminum. The final pinch diameter, plasma temperature, overall radiation pulse width, and spectrum are also quite different than aluminum z-pinch results. The z-pinch load consists of a wire array 1.25 or 1.5 cm in diameter, 2-cm long with a variable number of wires (8-24). The total

mass of the wire array is ~1 mg. Calculations suggest that the maximum kinetic energy which can be delivered to the imploding load is ~350 kJ. The total x-ray output of 600 kJ was significantly larger than the kinetic energy stored in the pinch. This result implies a non-kinetic source of energy. An estimate of the Spitzer resistivity gave a pinch resistance which, when coupled with the current in the load, could explain the difference between the total x-ray yield and the kinetic energy in the plasma.

28809 (DOE/ER/54160–1-Vol.3, pp. 2008-2013) **Different stabilization processes in Z-pinch plasma experimental approach.** Etlicher, B. (Laboratoire de Physique des Milieux Ionises, Palaiseau (France)); Veron, L.; Rouille, C.; Attelan, S.; Chuvatin, A.S.; Wessel, F.J.; Choi, P. Maryland Univ., College Park, MD (United States). [1992]. (CONF-920515–Vol.3: 9. international conference on high power particle beams, Washington, DC (United States), 25-29 May 1992). In *Beams 92: Proceedings: Volume 3, Microwaves, Free electron lasers, Advanced accelerators, Applications, and Plasma discharges.* 681p. Order Number DE94014785. Source: OSTI; NTIS; INIS.

The authors are investigating several methods to stabilize an aluminum vapor Z-pinch involving; applied axial magnetic fields, decreased z-current rise-time, and staged loads. The pinch is driven by a 2 Ω, 0.1 TW generator (~250 kA in ~50 ns) and is initiated in a plasma jet (3-mm diameter and 9-mm long) prepared by an exploded aluminum foil (5-mm thick). The axial-magnetic field is externally applied (B_{z0} ~50 G) or alternately, self-generated by a twisted discharge-return-current structure (B_{z0} <1 kG). The current risetime is decreased by a plasma opening switch (POS) located in the vacuum current feed, upstream of the pinch. The staged load involves a standard pinch imploded onto coaxial targets of conducting or nonconducting wires, i.e. plasma on wire (POW). Diagnostics include: Framing/streak camera, filtered PIN XRDs, PET crystal spectrometer, multi-pinhole x-ray photos. Qualitatively, the stability improves with an axial field and the x-ray yield is greater with a self-generated field (twisted return-current structure). With a plasma load the POS reduces the prepulse, sharpens the current rise-time and improves the x-ray yield. Overall the POW configuration is associated with the best stability and highest radiation yields.

28810 (DOE/ER/54160–1-Vol.3, pp. 2020-2025) **Multichannel X-ray spectral measurement of hot plasma evolution in nitrogen-puff Z-pinch.** Krejci, A. (Institute of Plasma Physics, Praha (Czechoslovakia)); Raus, J.; Piffl, V.; Golubev, A.V.; Platonov, Yu.Ya.; Krousky, E.; Renner, O. Maryland Univ., College Park, MD (United States). [1992]. (CONF-920515–Vol.3: 9. international conference on high power particle beams, Washington, DC (United States), 25-29 May 1992). In *Beams 92: Proceedings: Volume 3, Microwaves, Free electron lasers, Advanced accelerators, Applications, and Plasma discharges.* 681p. Order Number DE94014785. Source: OSTI; NTIS; INIS.

Soft x-ray emission from nitrogen plasma of gas-puff Z-pinch device (with energy input 4.3 kJ and current 160 kA) has been studied. Multilayer mirror polychromator with time-resolved registration by PIN diodes was installed and its relatively narrow spectral windows were aligned to the important parts of nitrogen spectrum between 390 and 710 eV. The T_e evolution (~400 eV in hot spots) was measured from a slope of recomb. continuum of He-like N. The T_e of bulk plasma (~100 eV) is compared with T_e calculated from yields of K-shell lines. Moreover, pinhole cameras were used for better understanding the radiation phase of the pinch. Time sequences of peaks in x-ray signals corresponding to a number of bright spots on photographs, are presented.

28811 (DOE/ER/54160–1-Vol.3, pp. 2026-2031) **Investigation of intense XUV emission of nitrogen-puff Z-pinch with small energy input.** Raus, J. (Institute of Plasma Physics, Praha (Czechoslovakia)); Krejci, A.; Piffl, V. Maryland Univ., College Park, MD (United States). [1992]. Contract 14301. (CONF-920515–Vol.3: 9. international conference on high power particle beams, Washington, DC (United States), 25-29 May 1992). In *Beams 92: Proceedings: Volume 3, Microwaves, Free electron lasers, Advanced accelerators, Applications, and Plasma discharges.* 681p. Order Number DE94014785. Source: OSTI; NTIS; INIS.

Light elements like nitrogen or carbon are suggested as optimum working media for small Z-pinches (several kJ energy input). It is shown that such elements can be ionized up to K-shell ionization stages not only in hot-spots, but also in the bulk plasma. The yield of nitrogen K-shell radiation (about 10 J/shot) is therefore substantially higher than that of traditionally used neon. Besides the pinch physics and radiation dynamics, such radiation could be of interest for applications in "water window" spectral region.

28812 (DOE/ER/54160–1-Vol.3, pp. 2032-2037) **Time resolved interferometry of plasma radiation source loads.** Yadlowsky, E.J. (HY-Tech Research Corp., Radford, VA (United States)); Hazelton, R.C.; Moschella, J.J.; Settersten, T.B. Maryland Univ., College Park, MD (United States). [1992]. (CONF-920515–Vol.3: 9. international conference on high power particle beams, Washington, DC (United States), 25-29 May 1992). In *Beams 92: Proceedings: Volume 3, Microwaves, Free electron lasers, Advanced accelerators, Applications, and Plasma discharges.* 681p. Order Number DE94014785. Source: OSTI; NTIS; INIS.

Models of imploding wire arrays usually assume an expansion and instantaneous ionization of the array material with the subsequent implosion proceeding as a distinct array of individual plasma elements or as a cylindrical shell. Experimental evidence indicates that precursor plasmas form and implode ahead of the array, x-ray pulse lengths are longer than 1D models predict, and part of the array mass is left behind. Interferometry with 10 to 1 magnification is used to probe the initial plasma formation processes. Results on Al and C loads indicate that neutral Al vapor cores or solid C cores persist for up to 400 to 600 ns into the current pulse, and that precursor plasma formation is possible. These results predict similar behavior for the first 40 to 60 ns on current generators with $\dot{I}$ per wire ~1.4 MA/μs.

28813 (DOE/ER/54160–1-Vol.3, pp. 2038-2043) **Magnetic pickup loop analysis on an exploding wire Z-pinch.** Moschella, J.J. (HY-Tech Research Corp., Radford, VA (United States)); Yadlowsky, E.J. Maryland Univ., College Park, MD (United States). [1992]. (CONF-920515–Vol.3: 9. international conference on high power particle beams, Washington, DC (United States), 25-29 May 1992). In *Beams 92: Proceedings: Volume 3, Microwaves, Free electron lasers, Advanced accelerators, Applications, and Plasma discharges.* 681p. Order Number DE94014785. Source: OSTI; NTIS; INIS.

Magnetic pickup loop signals obtained from an exploding wire Z-pinch have been analyzed on the HY-Tech Z-pinch. This machine can produce 300 kA at full charge rising in 1.5 μsec. By comparing the observed signals with a model of the driving circuit and stray elements, information on the dynamics of the load has been obtained. The load was modeled as an inductor, where the inductance is a function of the radius which varies with time. Streaked shadowgrams were used to monitor the wire radius for the first 300 nsec. It has been determined that an implosion occurs at least 0.3 μsec into the discharge and the duration of the implosion phase, according to the model, is near 50 nsec.

28814 (DOE/ER/54160–1-Vol.3, pp. 2044-2049) **Phenomenological modeling of argon Z-pinch implosions.** Whitney, K.G. (Naval Research Lab., Washington, DC (United States)); Thornhill, J.W.; Deeney, C.; LePell, P.D.; Coulter, M.C. Maryland Univ., College Park, MD (United States). [1992]. (CONF-920515–Vol.3: 9. international conference on high power particle beams, Washington, DC (United States), 25-29 May 1992). In *Beams 92: Proceedings: Volume 3, Microwaves, Free electron lasers, Advanced accelerators, Applications, and Plasma discharges.* 681p. Order Number DE94014785. Source: OSTI; NTIS; INIS.

The authors investigate some of the effects of plasma turbulence on the K-shell emission dynamics of argon gas puff Z-pinch implosions. The increases that turbulence produces in the plasma viscosity, heat conductivity, and electrical resistivity are modeled phenomenologically using multipliers for these quantities in the MHD calculations. The choice of multipliers was made by benchmarking a 1-D MHD simulation of a Physics International Inc. argon gas puff experiment against the inferred densities and temperatures achieved in the experiment. These multipliers were then used to study the parametric dependence of the K-shell emission on the energy input to the argon plasma for a fixed mass loading.

Comparisons between turbulent and non-turbulent argon implosions are made.

28815 (DOE/ER/54160–1-Vol.3, pp. 2050-2055) **Radiation hydrodynamics of an imploding argon puff gas plasma.** Davis, J. (Naval Research Lab., Washington, DC (United States)); Cochran, F.L. Maryland Univ., College Park, MD (United States). [1992]. (CONF-920515–Vol.3: 9. international conference on high power particle beams, Washington, DC (United States), 25-29 May 1992). In *Beams 92: Proceedings: Volume 3, Microwaves, Free electron lasers, Advanced accelerators, Applications, and Plasma discharges.* 681p. Order Number DE94014785. Source: OSTI; NTIS; INIS.

The implosion dynamics of an argon puff gas plasma is investigated using a 2-D radiation hydrodynamics/circuit model. The focus of this research is to determine and evaluate the radiative properties and performance of the imploding plasma for conditions created by driving a rapidly rising current through the Z-pinch load with a terawatt generator characteristic of the Double Eagle and Saturn simulators.

28816 (DOE/ER/54160–1-Vol.3, pp. 2056-2061) **Anomalous resistivity in a Z-pinch system.** Pulsifer, P.E. (Naval Research Lab., Washington, DC (United States)); Whitney, K.G. Maryland Univ., College Park, MD (United States). [1992]. (CONF-920515–Vol.3: 9. international conference on high power particle beams, Washington, DC (United States), 25-29 May 1992). In *Beams 92: Proceedings: Volume 3, Microwaves, Free electron lasers, Advanced accelerators, Applications, and Plasma discharges.* 681p. Order Number DE94014785. Source: OSTI; NTIS; INIS.

Microturbulence-mediated anomalous resistivity is a possible cause of observed anomalous heating in Z-pinch implosions. Conditions seen in MHD Z-pinch simulations suggest that the ion-acoustic instability could be a significant generator of turbulence. The authors employ a quasilinear kinetic theory to investigate electron heating in the presence of ion-acoustic turbulence in a moderately strong magnetic field. To lowest order, turbulence increases the effective electron-ion collision frequency. Simple scaling arguments for developed turbulence show that the collision frequency could be enhanced by one or two orders of magnitude in typical Z-pinch plasmas. Turbulent, strong-magnetic field heating produces depressed-tail electron distributions, but with local enhancements. The effect on resistivity of distribution function shape depends on the magnetic field, but turbulence always increases resistivity because of the higher effective collision frequency. Electrical resistivity of Z-pinch plasmas is calculated as a function of turbulence level.

28817 (DOE/ER/54160–1-Vol.3, pp. 2062-2067) **A numerical study of the stagnating compact toroid and its applicability as a radiation source.** Douglas, M.R. (Kirtland Air Force Base, Albuquerque, NM (United States)); Peterkin, R.E. Jr.; Hussey, T.W.; Bell, D.E.; Roderick, N.F. Maryland Univ., College Park, MD (United States). [1992]. (CONF-920515–Vol.3: 9. international conference on high power particle beams, Washington, DC (United States), 25-29 May 1992). In *Beams 92: Proceedings: Volume 3, Microwaves, Free electron lasers, Advanced accelerators, Applications, and Plasma discharges.* 681p. Order Number DE94014785. Source: OSTI; NTIS; INIS.

Using a compact toroid (CT) as a radiation source is one of the many applications being pursued by the MARAUDER CT program at the Phillips Lab. CT radiation production can be achieved via the stagnation of a high velocity plasma ring against a stationary object. A computational analysis of this process is underway using the 2 1/2-dimensional RMHD code MACH2. Preliminary simulations reveal that the stagnation process results in an inelastic collision between the CT and the wall. Estimates indicate a kinetic to radiation energy conversion of approximately 20% aiding in significant radiation output.

28818 (DOE/ER/54160–1-Vol.3, pp. 2068-2073) **Hydrodynamics of a stagnating ring-puff plasma.** Clark, R.W. (Naval Research Lab., Washington, DC (United States)); Davis, J.; Les, J. Maryland Univ., College Park, MD (United States). [1992]. (CONF-920515–Vol.3: 9. international conference on high power particle beams, Washington, DC (United States), 25-29 May 1992). In *Beams 92: Proceedings: Volume 3, Microwaves, Free electron lasers, Advanced accelerators, Applications, and Plasma discharges.* 681p. Order Number DE94014785. Source: OSTI; NTIS; INIS.

The dynamics of an argon ring-puff plasma stagnating on a planar iron target is investigated theoretically and numerically. At stagnation, the high velocity argon ring-puff converts much of its kinetic energy to thermal and ionization energy which is then converted to radiation. The intensity, spectra, and pulselength of the emitted radiation produce an interesting x-ray radiation source with a potentially large number of applications. The authors present the results of their simulations and characterize the radiation source. During the plasma expansion phase population inversions were found in the hydrogen-like ionization stage of argon; their significance is discussed.

28819 (DOE/ER/54241–131) **Papers presented at the Tenth Topical Conference on High-Temperature Plasma Diagnostics.** Texas Univ., Austin, TX (United States). [1994]. 253p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG03-94ER54241. (FRCR–446; CONF-940552–: 10. topical conference on high-temperature plasma diagnostics, Rochester, NY (United States), 8-12 May 1994). Order Number DE94015854. Source: OSTI; NTIS; INIS; GPO Dep.

This report contains papers on the following topics: Effects of limited spatial resolution on fluctuation measurements; vertical viewing of electron-cyclotron radiation in Text-U; measurement of temperature fluctuations from electron-cyclotron emission; a varying cross section magnetic coil diagnostic used in digital feedback control of plasma position in Text-Upgrade; high-sensitivity, high resolution measurements of radiated power on Text-U; wave launching as a diagnostic tool to investigate plasma turbulence; edge parameters from an energy analyzer and particle transport on Text-U; initial results from a charge exchange q-Diagnostic on Text-U; a method for neutral spectra analysis taking ripple-trapped particle losses into account; application of a three sample volume$^{S(k,\omega)}$ estimate to optical measurements of turbulence on Text; initial operation of the 2D Firsis on Text-Upgrade; horizontal-view interferometer on Text-Upgrade; plasma potential measurements on Text-Upgrade with A 2 MeV heavy ion beam; fluctuation measurements using the 2 MeV heavy ion beam probe on Text-U; the time domain triple probe method; a phase contrast imaging system for Text-U; and development of rugged corner cube detectors for the Text-U-Fir interferometer. These papers have been placed on the database elsewhere.

28820 (DOE/ER/54241–132) **A method for neutral spectral analysis taking ripple-trapped particle losses into account.** Dnestrovskij, A. Yu (Kurchatov Inst. of Atomic Energy, Moscow (Russian Federation)); Bengtson, R.D.; Karzhavin, Y.; Ouroua, A. Texas Univ., Austin, TX (United States). Fusion Research Center. 24 Jun 1994. 12p. Sponsored by USDOE, Washington, DC (United States);National Science Foundation, Washington, DC (United States). DOE Contract FG03-94ER54241 ; FG05-88ER53267. (FRCR–447). Order Number DE94015855. Source: OSTI; NTIS; INIS; GPO Dep.

An analysis technique of charge exchange neutral spectra is proposed tested to obtain ion temperatures of a tokamak plasma. The technique models the deviation of the "ion distribution from Maxwellian because of ripple trapped particles and introduces a hot ion effective temperature as a fitting parameter. The analysis code has been used to analyze active charge exchange data from TEXT discharges in which a significant up-down asymmetry in the neutral spectra was noted. An analysis considering ripple trapped particles removed some of the asymmetry and indicated the need for another mechanism for distorting charge exchange spectra. The estimations of halo neutrals effect on charge exchange neutral spectra are performed.

28821 (GA-A–21347) **Fusion programs in applied plasma physics: Technical progress report, July 11, 1992–May 31, 1993.** General Atomics, San Diego, CA (United States). Jul 1993. 45p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG03-92ER54150. Order Number DE94015853. Source: OSTI; NTIS; INIS; GPO Dep.

This report summarizes the progress made in theoretical and experimental research funded by US Department of Energy Grant No. DE-FG03-92ER54150, during the period July 11, 1992 through May 31, 1993. Four main tasks are reported: applied plasma physics theory, alpha particle diagnostic, edge and current density diagnostic, and plasma rotation drive. The report also discusses the research plans for the theory and experimental programs for the next grant year. Reports and publications supported by the grant during this period are listed in the final section.

28822 (GA-A–21466) **Advanced tokamak research on the DIII-D tokamak.** Chan, V.S. General Atomics, San Diego, CA (United States). Jan 1994. 19p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG03-92ER54150 ; AC03-89ER51114. (CONF-9310340–1: Workshop on nuclear fusion and plasma physics, Hefei (China), 4-15 Oct 1993). Order Number DE94015860. Source: OSTI; NTIS; INIS; GPO Dep.

The objective of the planned research in advanced tokamak development on DIII-D at General Atomics, San Diego, USA. is to establish improved tokamak operation through significant improvements in the stability factor, confinement quality, and bootstrap current fraction using localized radio frequency (rf) current profile control, rf and neutral beam heating for pressure profile control, as well as control of plasma rotation and optimization of the plasma boundary conditions. Recent research results in H-mode confinement, modifications of current profiles to achieve higher confinement and higher β, a new regime of improved confinement (VH-mode), and rf noninductive current drive are encouraging. In this talk, arguments will be presented supporting the need for improved performance in tokamak reactors. Experimentally observed advanced performance regimes on DIII-D will be discussed. Confinement improvement up to H = 4, where H is the ratio of energy confinement time to the ITER89-P scaling $H \equiv \tau_E/\tau_{E-ITER89-P}$, has been achieved. In other discharges $\beta_N = \beta/(I/aB),[\%\cdot m\cdot T/MA] \gtrsim 6$ has been obtained. These values have so far been achieved transiently and independently. Techniques, will be described which can extend the high performance to quasi-steady-state and sustain the high H and β_N values simultaneously. Two high performance regimes, one in first stable regime and the other in second stable regime, have been simulated br self-consistently evolving a magnetohydrodynamic (MHD) equilibrium-transport code. Finally, experimental program plans and outstanding important physics issues will be discussed.

28823 (GA-A–21523) **Poloidal rotation and the evolution of H-mode and VH-mode profiles.** Hinton, F.L.; Staebler, G.M.; Kim, Y.B. General Atomics, San Diego, CA (United States). Dec 1993. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG03-92ER54150 ; AC03-89ER51114. (CONF-9311147–9: IAEA meeting on H-mode physics, Naka (Japan), 15-17 Nov 1993). Order Number DE94015858. Source: OSTI; NTIS; INIS; GPO Dep.

The physics which determines poloidal rotation, and its role in the development of profiles during H- and VH-modes, is discussed. A simple phenomenological transport model, which incorporates the $\vec{E} \times \vec{B}$ flow shear suppression of turbulence, is shown to predict profile evolution similar to that observed experimentally during H-mode and VH-mode.

28824 (GA-A–21737) **The effect of the edge current density on confinement and kink mode stability in H-mode and VH-mode discharges.** Ferron, J.R. (General Atomics, San Diego, CA (United States)); Lao, L.L.; Osborne, T.H.; Strait, E.J.; Taylor, T.S.; Thompson, S.J.; Turnbull, A.D.; Sauter, O. General Atomics, San Diego, CA (United States). Jul 1994. 4p. Sponsored by USDOE, Washington, DC (United States);Swiss National Science Foundation, Bern (Switzerland). DOE Contract AC03-89ER51114. (CONF-940635–4: 21. European conference on controlled fusion and plasma physics, Marseilles (France), 26 Jun - 1 jul 1994). Order Number DE94015719. Source: OSTI; NTIS; INIS; GPO Dep.

The effect of the local current density in the outer portion of a tokamak discharge [$J(\rho \sim a)$] is discussed in three situations. In a H-mode discharge, a strong reduction of $J(\rho \sim a)$ results in the loss of the H-mode pressure pedestal. A smaller reduction in $J(\rho \sim a)$ can prevent the transition from H-mode to VH-mode. Finally, a sufficiently large value of $J(\rho \sim a)$ accompanied by a sufficiently large value of the pressure gradient in the same region of the discharge, can destabilize low-n (e.g., n = 1 to 5) kink-type modes in a VH-mode discharge.

28825 (IPP–1/262) **Magnetic diagnostic on ASDEX upgrade with internal and external pick-up coils.** Gernhardt, J. Max-Planck-Institut fuer Plasmaphysik, Garching (Germany). Nov 1992. 135p. Order Number DE94790628. Source: OSTI; NTIS (US Sales Only); INIS.

ASDEX Upgrade tries to match the physical requirements of a poloidal field divertor to technical reactor needs. The plasma configuration fits present day reactor concepts (INTOR, ITER) on smaller scale. The aims of the AUG include two technical problems: Control of the non-circular bulk plasma configuration and control of the plasma boundary or divertor configuration respectively. For these purposes an exact measurement and adjustment of magnetic fields is required. Axial symmetry can be assumed for all plasma equilibria with a toroidal field component B_ϕ and two poloidal field components B_r and B_z. The measurements of field components in a vertical plane containing the axis are sufficient. Axissymmetry may be destroyed by eddy currents in metallic structure and stable or unstable plasma disturbances. Their investigations require measurements also in planes of different toroidal angles. Mode analysis of plasma disturbances can be detected by a selected numbers of signals on a poloidal circumference and on a toroidal circumference. With this so called Mirnov mode analysis, a determination of the poloidal mode number $1<m<20$ and toroidal mode number $n<3$ is possible. (orig.)

28826 (IPP–1/271) **Electron and ion heat transport with lower hybrid current drive and neutral beam injection heating in ASDEX.** Soeldner, F.X; Pereverzev, G.V.; Bartiromo, R.; Fahrbach, H.U.; Leuterer, F.; Murmann, H.D.; Staebler, A.; Steuer, K.H. Max-Planck-Institut fuer Plasmaphysik, Garching (Germany). Nov 1992. 23p. Order Number DE94790644. Source: OSTI; NTIS (US Sales Only); INIS.

Transport code calculations were made for experiments with combined operation of Lower Hybrid current drive and heating and neutral beam injection heating on ASDEX. Peaking or flattening of the electron temperature profile is mainly explained with MHD-induced electron heat transport. It is governed by current profile changes due to Lower Hybrid and neutral beam current drive and contributions from the bootstrap current. Ion heat transport can not be described with one single model for all heating scenarios. The ion heat conductivity is reduced during Lower Hybrid heated phases with respect to Ohmic and neutral beam heating and drops below the neoclassical value. (orig.). 6 figs.

28827 (IPP–2/318) **Studies on a stellarator reactor of the Helias type: The power balance.** Beidler, C.D.; Harmeyer, E.; Kisslinger, J.; Ott, I.; Rau, F.; Wobig, H. Max-Planck-Institut fuer Plasmaphysik, Garching (Germany). Jun 1993. 25p. Order Number DE94790629. Source: OSTI; NTIS (US Sales Only); INIS.

The power balance of a Helias reactor is analysed using empirical scaling laws which describe current stellarator experiments. Since neoclassical transport in Helias configurations is not prohibitive to ignition, anomalous transport determines the parameters of the ignited state. In the following study the plasma profiles are taken as given and the power balance with an external heating power is evaluated numerically. Three empirical scaling laws, LHD-scaling, Gyro-Bohm scaling and Lackner-Gottardi scaling are extrapolated to reactor parameters. Present experiments (Wendelstein 7-AS, ATF, Heliotron E and CHS) can be described by these scaling laws, in Wendelstein 7-AS preference is given to the Lackner-Gottardi scaling since confinement improves with increasing rotational transform. LHD scaling and Gyro-Bohm scaling do not satisfy the ignition conditions; an improvement of confinement is necessary. However, Lackner-Gottardi scaling meets the ignition condition and the operating window of the Helias reactor was found in the following regime: Major radius 20 m, average plasma radius 1.6 m, magnetic field 5 T, density $n(0)=3\text{-}4\times10^{20}$ m^{-3} and temperature $T(0)\approx15\text{-}17$ keV. The fusion output power is 2.5-3.0 GW and the average value of β=4-5%. This lies within the MHD-stability limits of a Helias configuration. The effects of various parameter

variations on the power balance (isotope effect, α-particle content, major radius, magnetic field) are also investigated. (orig.)

28828 (IPP–4/258) **Spectroscopic determination of species and divergence of hydrogen beams in the W7AS neutral beam injectors.** Ott, W.; Penningsfeld, F.P. Max-Planck-Institut fuer Plasmaphysik, Garching (Germany). Jan 1993. 26p. Order Number DE94790645. Source: OSTI; NTIS (US Sales Only); INIS.

Light-collecting systems are installed at the neutralizers of the W7AS neutral beam lines. They receive light emitted at an angle of 120 to the beam axes. Hydrogen beams are analyzed at around the wavelength of H_α (6562.8 A), helium beams at around 5875.6 A. The hydrogen spectra show the well-known shifted and unshifted lines emitted by the different beam species and the background gas. The line widths are mainly determined by the beam focussing, the beamlet divergence and the apparatus profile. Knowing the focussing properties of the ion source and the instrument function of the spectrometer, one can determine the beamlet divergence. The spectrum is approximated by a series of Gaussians using least-squares fitting methods and evaluated with respect to beam species and divergence. Evaluation of the spectra proved difficult because they show a structured background, which is observed in the whole range of the Doppler shift. It is shown with helium beams that the background is caused by wall reflection of light emitted by the beam in the whole angular range between 0 and 180 . The knowledge of the background structure gained with He beams allows interpretation of the more complicated hydrogen spectra. (orig.)

28829 (IPP–6/315) **Surface current equilibria from a geometric point of view.** Kaiser, R.; Salat, A. Max-Planck-Institut fuer Plasmaphysik, Garching (Germany). Apr 1993. 43p. Order Number DE94790664. Source: OSTI; NTIS (US Sales Only); INIS.

This paper addresses the inverse problem of the existence of surface current MHD equilibria in toroidal geometry with vanishing magnetic field inside. Inverse means that the plasma-vacuum interface rather than the external wall or conductors are given and the latter remain to be determined. This makes a reformulation of the problem possible in geometric terms: What toroidal surfaces with analytic parameterization allow a simple analytic covering by geodesics? If such a covering by geodesics (field lines) exists, their orthogonal trajectories (current lines) also form a simple covering and are described by a function satisfying a nonlinear partial differential equation of the Hamilton-Jacobi type whose coefficients are combinations of the metric elements of the surface. All known equilibria - turn out to be solutions of separable cases of that equation and allow a unified description if the toroidal surface is parametrized in the moving trihedral associated with a closed curve. Analogously to volume current equilibria, the only continuous symmetries compatible with separability are plane, helical and axial symmetry. In the nonseparable case numerical evidence is presented for cases with chaotic behaviour of geodesics, thus restricting possible equilibria for these surfaces. For weak deviation from axisymmetry KAM-type behaviour is observed, i.e. destruction of geodesic coverings with a low rational rotational transform and preservation of those with irrational rotational transform. A previous attempt to establish three-dimensional surface current equilibria on the basis of the KAM theorem is rejected as incomplete, and a complete proof of the existence of equilibria in the weakly nonaxisymmetric case, based on the twist theorem for mappings, is given. Finally, for a certain class of strong deviations from axisymmetry an analytic criterion is formulated which rules out equilibria for these surfaces. (orig.)

28830 (IYaF–93-70) **Gas-dynamic trap diagnostic complex for study on plasma heating and power atomic beam injection.** Bagryanskij, P.A. (and others); Bocharov, V.N.; Dejchuli, P.P. AN SSSR, Novosibirsk (Russian Federation). Inst. Yadernoj Fiziki. 1993. 44p. (In Russian). Order Number DE94633377. Source: OSTI; NTIS (US Sales Only); INIS.

Gas-dynamic trap (GDT) constitutes an open trap with long central part and axial-symmetric MGD-stabilizers at the ends. 37 refs.

28831 (IYaF–93-89) **On conception of a compact neutron source and the possibility of its simulation on the Amba-M end trap.** Dimov, G.I.; Kabantsev, A.A.; Sokolov, V.G.; Taskaev, S.Yu. AN SSSR, Novosibirsk (Russian Federation). Inst. Yadernoj Fiziki. 1993. 13p. (In Russian). Order Number DE94633373. Source: OSTI; NTIS (US Sales Only); INIS.

Classical end trap Budker-Post with thermobarriers in traps is proposed to apply for obtaining neutron flux of > 500 kW power and 2-3 $MW.m^{-2}$ density. 4 refs.

28832 (LA-UR–94-1605) **Measurements of DT and DD neutron yields by neutron activation on TFTR.** Barnes, C.W. (Los Alamos National Lab., NM (United States)); Larson, A.R.; LeMunyan, G.; Loughlin, M.J. Los Alamos National Lab., NM (United States). 5 May 1994. 14p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-940552–15: 10. topical conference on high-temperature plasma diagnostics, Rochester, NY (United States), 8-12 May 1994). Order Number DE94014819. Source: OSTI; NTIS; INIS; GPO Dep.

A variety of elemental foils have been activated by neutron fluence from TFTR under conditions with the DT neutron yield per shot ranging from 10^{12} to over 10^{18}, and with the DT/(DD+DT) neutron ratio varying from 0.5% (from triton burnup) to unity. Linear response over this large dynamic range is obtained by reducing the mass of the foils and increasing the cooling time, all while accepting greatly improved counting statistics. Effects on background gamma-ray lines from foil-capsule-material contaminants. and the resulting lower limits on activation foil mass, have been determined. DT neutron yields from dosimetry standard reactions on aluminum, chromium, iron, nickel, zirconium, and indium are in agreement within the ±9% (one-sigma,) accuracy of the measurements: also agreeing are yields from silicon foils using the ACTL library cross-section. While the ENDF/B-V library has too low a cross-section. Preliminary results from a variety of other threshold reactions are presented. Use of the $^{115}In(n,n)\,^{115m}In$ reaction (0.42 times as sensitive to DT neutrons as DD neutrons) in conjunction with pure-DT reactions allows a determination of the DT/(DD+DT) ratio in trace tritium or low-power tritium beam experiments.

28833 (LA-UR–94-2438) **Intense ion beam optimization and characterization with thermal imaging.** Davis, H.A.; Bartsch, R.R.; Rej, D.J.; Waganaar, W.J. Los Alamos National Lab., NM (United States). [1994]. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-940634–13: 10. international conference on high power particle beams, San Diego, CA (United States), 20-24 Jun 1994). Order Number DE94016184. Source: OSTI; NTIS; INIS; GPO Dep.

The authors have developed thermal imaging of beam targets to optimize and characterize intense ion beams. The technique, which measures the beam energy-density distribution on each machine firing, has been used to rapidly develop and characterize two very different beams–a 400 kV beam used to study materials processing, and an 80 kV beam use for magnetic fusion diagnostics.

28834 (ORNL/TM–12721) **Numerical solution of a tunneling equation.** Wang, C.Y.; Carter, M.D.; Batchelor, D.B.; Jaeger, E.F. Oak Ridge National Lab., TN (United States). Apr 1994. 22p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE94015514. Source: OSTI; NTIS; INIS; GPO Dep.

A numerical method is presented to solve mode conversion equations resulting from the use of radio frequency (rf) waves to heat plasmas. The solutions of the mode conversion equations contain exponentially growing modes, and ordinary numerical techniques give large errors. To avoid the unphysical growing modes, a set of boundary conditions are found, that eliminate the unphysical modes. The mode conversion equations are then solved with the boundary conditions as a standard two-point boundary value problem. A tunneling equation (one of the mode conversion equations without power absorption) is solved as a specific example of this numerical technique although the technique itself is very general and can be easily applied to solve any mode conversion equation. The results from the numerical calculation agree very well with those found from asymptotic analysis.

28835 (ORNL/TM–12757) **Feedback control and stabilization experiments on the Texas Experimental Tokamak (TEXT).** Uckan, T. (Oak Ridge National Lab., TN (United States)); Carreras, B.A.; Richards, B.; Wootton, A.J.; Bengtson, R.D.; Bravenec, R.; Li,

G.X.; Hurwitz, P.D.; Phillips, P.E.; Rowan, W.L. Oak Ridge National Lab., TN (United States). Jun 1994. 17p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE94015214. Source: OSTI; NTIS; INIS; GPO Dep.

Plasma edge feedback experiments on the Texas Experimental Tokamak (TEXT) have been successful in controlling the edge plasma potential fluctuation level. The feedback wave-launcher, consisting of electrostatic probes located in the shadow of the limiter, is driven by the local edge potential fluctuations. In general, the edge potential fluctuations are modified in a broad frequency band. Moreover, it is observed that the potential fluctuations can be reduced ($\leq$100 kHz) without enhancing other modes, or excited (10 to 12 kHz), depending on the phase difference between the driver and the launcher signal, and gain of the system. This turbulence modification is achieved not only locally but also halfway around the torus and has about 2 cm of poloidal extent. Experiments on the characterization of the global plasma parameters with the edge feedback are discussed. Effects of the edge feedback on the estimated fluctuation-induced radial particle flux as well as on the local plasma parameters are presented.

28836 (PPPL–2998) **Excitation of Alfven Cyclotron instability by charged fusion products in tokamaks.** Gorelenkov, N.N.; Cheng, C.Z. Princeton Univ., NJ (United States). Plasma Physics Lab. Aug 1994. 30p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH03073. Order Number DE94016411. Source: OSTI; NTIS; INIS; GPO Dep.

The spectrum of ion cyclotron emission (ICE) observed in tokamak experiments shows narrow peaks at multiples of the edge cyclotron frequency of background ions. A possible mechanism of ICE based on the fast Alfven Cyclotron Instability (ACI) resonantly excited by high energy charged products (α-particles or protons) is studied here. The two-dimensional ACI eigenmode structure and eigenfrequency are obtained in the large tokamak aspect ratio limit. The ACI is excited via wave-particle resonances in phase space by tapping the fast ion velocity space free energy. The instability growth rates are computed perturbatively from the perturbed fast particle distribution function, which is obtained by integrating the high frequency gyrokinetic equation along the particle orbit. Numerical examples of ACI growth rates are presented for TFTR plasmas. The fast ion distribution function is assumed to be singular in pitch angle near the plasma edge. The results are employed to understand the ICE in Deuterium-Deuterium (DD) and Deuterium-tritium (DT) tokamak experiments.

28837 (PPPL–3002) **Reflectometer measurements of density fluctuations in tokamak plasmas.** Nazikian, R.; Mazzucato, E. Princeton Univ., NJ (United States). Plasma Physics Lab. Aug 1994. 26p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH03073. Order Number DE94016412. Source: OSTI; NTIS; INIS; GPO Dep.

We show that many anomalous features observed in reflectometer measurements of turbulent fluctuations in tokamak plasmas, such as loss of coherent reflection, large amplitude fluctuations, large angular divergence of the reflected waves and correlation lengths of the order of the free space wavelength of the probe beam, can be explained by modeling the plasma fluctuations as a poloidally varying random phase grating located at the cutoff with a phase magnitude given by 1D geometric optics. A key result of our analysis is that the turbulence spectrum cannot be inferred from phase measurements when large amplitude fluctuations are observed at the receiver. However, the turbulence spectrum may still be recovered from phase measurements by use of imaging optics, and wide angle phase sensitive receivers.

28838 (PPPL–3003) **Effects of turbulent fluctuations on density measurements with microwave reflectometry in tokamaks.** Mazzucato, E.; Nazikian, R. Princeton Univ., NJ (United States). Plasma Physics Lab. Aug 1994. 14p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH03073. Order Number DE94016413. Source: OSTI; NTIS; INIS; GPO Dep.

The short-scale turbulence of tokamak plasmas has deleterious effects on the measurement of plasma density with microwave reflectometry. Density fluctuations may lead to large amplitude and phase modulations of the reflected wave which can impair the measurement of the wave group delay, and hence the determination of the plasma density. The role played by different types of turbulent fluctuations and the limitations imposed on microwave reflectometry are discussed in this paper.

28839 (PPPL-CFP–3101) **Tritium transport studies on TFTR.** Johnson, L.C. (Princeton Univ., NJ (United States). Plasma Physics Lab.); Efthimion, P.C.; Strachan, J.D.; Synakowski, E.; Zarnstorff, M.; McCune, D.; Roquemore, A.L.; Loughlin, M.; Barnes, C.W. Princeton Univ., NJ (United States). Plasma Physics Lab. [1994]. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH03073 ; W-7405-ENG-36. (LA-UR–94-2430; CONF-940635–2: 21. European conference on controlled fusion and plasma physics, Marseilles (France), 26 Jun - 1 jul 1994). Order Number DE94015563. Source: OSTI; NTIS; INIS; GPO Dep.

This paper reports the first results of tritium transport studies on TFTR. Gas puffs of either pure tritium or trace-tritium (2% T_2 and 98% D_2) were injected into low-recycling deuterium neutral beam heated plasmas, referred to as supershots, and the temporal and spatial evolution of the resulting 14.1 MeV t(d,n)α neutron emission was measured. Because of the high reactivity of tritium with energetic deuterons, small gas puffs are sufficient to provide a significant increase in neutron emissivity without seriously perturbing other plasma parameters. By analyzing the time evolution of the D-T neutron emission profile after a gas puff, the local tritium density may be inferred. In order to compare with earlier work on TFTR, we chose plasma conditions to closely match those of the supershots studied. A total of $\approx$14 MW of deuterium neutral beams, with a maximum energy of $\approx$100 keV, were injected both co-tangential and counter-tangential with respect to plasma current, to minimize plasma rotation. The plasma had a toroidal field strength of 4.8 T, a major radius of 2.45 m, a minor radius of 0.8 m, and a plasma current of 1.15 MA. The central electron and ion temperatures were 7.5 keV and 25 keV, respectively, and the central electron density was 5×10^{19} m^{-3}. Global energy confinement time was 0.16 s, which is about three times the L-mode scaling value. Neutral beam injection was from 3 to 4 s, and the tritium gas puff was applied at 3.5 s.

28840 (PPPL-CFP–3102) **Recent results from the TFTR ICRF DT program.** Rogers, J.H. (and others); Darrow, D.; Majeski, R. Princeton Univ., NJ (United States). Plasma Physics Lab. [1994]. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH03073. (CONF-940635–3: 21. European conference on controlled fusion and plasma physics, Marseilles (France), 26 Jun - 1 jul 1994). Order Number DE94015562. Source: OSTI; NTIS; INIS; GPO Dep.

The first experiments to be performed with ICRF heating of DT plasmas are reported. ICRF heating of minority ions, tritium (second harmonic resonance), as well as direct electron heating are being performed during the DT phase of TFTR. RF power modulation and Fourier transform techniques are used to attempt to elucidate the competition between tritium second harmonic, direct electron, and ^{3}He fundamental heating in DT plasmas. A significant fraction of the RF power has been found to couple to the tritium ions via second harmonic heating. Relevant RF coupling physics is investigated using ^{3}He minority heating (43 MHz), H minority heating (64 MHz), and mode conversion (43 MHz, comparable densities of ^{3}He and ^{4}He) at a toroidal field of 4.5T.

28841 (PPPL-TH–94-1) **Princeton University Plasma Physics Laboratory, Theory Division, quarterly progress report, January 1–March 31, 1994.** White, R.B. (ed.). Princeton Univ., NJ (United States). Plasma Physics Lab. [1994]. 13p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH03073. Order Number DE94016414. Source: OSTI; NTIS; INIS; GPO Dep.

This report discusses microinstability properties and transport in advanced plasma configurations.

28842 (SAND–94-1712) **Boundary conditions for fluid equations with flux sources and sinks.** Riley, M.E. Sandia National Labs., Albuquerque, NM (United States). 8 Jun 1994. 15p. Sponsored by USDOE, Washington, DC (United States). DOE

Contract AC04-94AL85000. Order Number DE94015780. Source: OSTI; NTIS; GPO Dep.

I use a piece-wise linear approximation to the directed flux expressions for a flowing Maxwellian fluid to write down boundary conditions for the fluid description of a multicomponent plasma. These boundary conditions are sufficiently robust to treat particle reflection, surface reactions leading to secondary production, diffusion, and field-induced drift of charged species.

28843 (SAND–94-1874C) **Studies of the ablated plasma from experimental plasma gun disruption simulations.** Rockett, P.D. (Sandia National Labs., Albuquerque, NM (United States)); Hunter, J.A.; Bradley, J.T. Sandia National Labs., Albuquerque, NM (United States). [1994]. 16p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. (CONF-940580–6: 11. international conference on plasma surface interactions in controlled fusion devices, Mito (Japan), 23-27 May 1994). Order Number DE94015017. Source: OSTI; NTIS; INIS; GPO Dep.

Extensive simulations of Tokamak disruptions have provided a picture of material erosion that is limited by the transfer of energy from the incident plasma to the armor solid surface through a dense vapor shield. Radiation spectra were recorded in the VUV and in the visible at the Efremov Laboratories on VIKA using graphite targets. The VUV data were recorded with a Sandia Labs transmission grating spectrograph, covering 1–40 nm. Plasma parameters were evaluated with incident plasma energy densities varying from 1–10 kJ/cm^2. A second transmission grating spectrograph was taken to 2MK-200 at TRINITI to study the plasma-material interface in magnetic cusp plasma. Target materials included POCO graphite, ATJ graphite, boron nitride, and plasma-sprayed tungsten. Detailed spectra were recorded with a spatial resolution of ~1 mm resolution. Time-resolved data with 40–200 ns resolution was also recorded. The data from both plasma gun facilities demonstrated that the hottest plasma region was sitting several millimeters above the armor tile surface.

28844 (UCRL-JC–116212) **Absorption of intense microwaves and ion acoustic turbulence due to heat transport.** De Groot, J.S. (California Univ., Davis, CA (United States)); Liu, J.M.; Matte, J.P. Lawrence Livermore National Lab., CA (United States). 4 Feb 1994. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-931048–15: 11. international workshop on laser interaction and related plasma phenomena, Monterey, CA (United States), 25-29 Oct 1993). Order Number DE94015140. Source: OSTI; NTIS; GPO Dep.

Measurements and calculations of the inverse bremsstrahlung absorption of intense microwaves are presented. The isotropic component of the electron distribution becomes flat-topped in agreement with detailed Fokker-Planck calculations. The plasma heating is reduced due to the flat-topped distributions in agreement with calculations. The calculations show that the heat flux at high microwave powers is very large, $q_{max} \approx 0.3\ n_e v_e T_e$. A new particle model to, calculate the heat transport inhibition due to ion acoustic turbulence in ICF plasmas is also presented. One-dimensional PIC calculations of ion acoustic turbulence excited due to heat transport are presented. The 2-D PIC code is presently being used to perform calculations of heat flux inhibition due to ion acoustic turbulence.

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Refer also to citation(s) 27689, 27690, 27692, 28035, 28181, 28182, 28245, 28365, 28751, 28799

28845 (ANL/ET/CP–83581) **Development of insulating coatings for liquid metal blankets.** Malang, S. (Kernforschungszentrum Karlsruhe GmbH (Germany)); Borgstedt, H.U.; Farnum, E.H.; Natesan, K.; Vitkovski, I.V. Argonne National Lab., IL (United States). Jul 1994. 45p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-940664–24: ISFNT-3: 3rd international symposium on fusion nuclear technology, Los Angeles, CA (United States), 27 Jun - 1 jul 1994). Order Number DE94016305. Source: OSTI; NTIS; INIS; GPO Dep.

It is shown that self-cooled liquid metal blankets are feasible only with electrically insulating coatings at the duct walls. The requirements on the insulation properties are estimated by simple analytical models. Candidate insulator materials are selected based on insulating properties and thermodynamic consideration. Different fabrication technologies for insulating coatings are described. The status of the knowledge on the most crucial feasibility issue, the degradation of the resisivity under irradiation, is reviewed.

28846 (ANL/FPP/TM–266) **Characteristics of the neutron flux from a D-Li neutron source.** Gomes, I.; Smith, D.L. Argonne National Lab., IL (United States). Jul 1994. 23p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. Order Number DE94016007. Source: OSTI; NTIS; INIS; GPO Dep.

A D-Li neutron source produces a high flux of neutrons which can be used for testing fusion materials. The characteristics exhibited by the neutron flux inside the test assembly volume of a D-Li neutron source irradiation facility is a function of several design options, such as deuteron energy, beam current, beam cross sectional area, and lithium target configuration, among others. The influence of each of these parameters on the overall performance of the machine, in terms of best results for irradiation of materials for fusion applications, can be inferred by scoping their impact on the uncollided neutron flux magnitude and distribution. The first part of this paper describes an analysis performed on the uncollided neutron flux (without material inside the test assembly region) for different beam-target configurations for determining the effect of varying the elements of the configuration on the uncollided neutron flux gradient. The second section deals with the neutron energy spectrum from the D-Li reaction and a brief discussion on "fusion reactor spectrum" is also presented. In the third section results from calculations of the volume with uncollided neutron above a threshold value are presented.

28847 (ANL/TD/CP–81425) **Comparison of lithium and the eutectic lead lithium alloy, two candidate liquid metal breeder materials for self-cooled blankets.** Malang, S. (Kernforschungszentrum Karlsruhe GmbH (Germany)); Mattas, R. Argonne National Lab., IL (United States). Jun 1994. 24p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-940664–18: ISFNT-3: 3rd international symposium on fusion nuclear technology, Los Angeles, CA (United States), 27 Jun - 1 jul 1994). Order Number DE94015068. Source: OSTI; NTIS; INIS; GPO Dep.

Liquid metals are attractive candidates for both near-term and long-term fusion applications. The subjects of this comparison are the differences between the two candidate liquid metal breeder materials Li and LiPb for use in breeding blankets in the areas of neutronics, magnetohydrodynamics, tritium control, compatibility with structural materials, heat extraction system, safety, and required R&D program. Both candidates appear to be promising for use in self-cooled breeding blankets which have inherent simplicity with the liquid metal serving as both breeders and coolant. The remaining feasibility question for both breeder materials is the electrical insulation between liquid metal and duct walls. Different ceramic coatings are required for the two breeders, and their crucial issues, namely self-healing of insulator cracks and radiation induced electrical degradation are not yet demonstrated. Each liquid metal breeder has advantages and concerns associated with it, and further development is needed to resolve these concerns.

28848 (ANL/TD/CP–81660) **MHD pressure drops and thermal hydraulic analysis for the ITER breeding blanket design.** Hua, Thanh Q. (Argonne National Lab., IL (United States)); Gohar, Y. Argonne National Lab., IL (United States). Jun 1994. 23p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-940664–19: ISFNT-3: 3rd international symposium on fusion nuclear technology, Los Angeles, CA (United States), 27 Jun - 1 jul 1994). Order Number DE94015085. Source: OSTI; NTIS; INIS; GPO Dep.

The breeding blanket design of the International Thermonuclear Experimental Reactor (ITER) is a self-cooled liquid lithium system

with a vanadium structure. Electrical insulation of the coolant channel surfaces from the liquid metal is required to reduce the magnetohydrodynamic (MHD) pressure to less than 1 MPa. Insulation is provided by AlN coating at the channel surfaces in contact with lithium. MHD pressure drop and thermal hydraulic analysis of the blanket design is carried out subject to pressure, temperature, and stress considerations. Design windows relating the lithium flow velocity, MHD pressure, and structural temperature are formulated. The requirements of the insulator coating and characterization of the coating effectiveness are presented. Effects on the MHD pressure drop due to uniform cracks through the coating layer is also analyzed.

28849 (ANL/TD/CP–82060) **An assessment of disruption erosion in the ITER environment.** Hassanein, A. (Argonne National Lab., IL (United States)); Konkashbaev, I. Argonne National Lab., IL (United States). Jun 1994. 24p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-940664–23: ISFNT-3: 3rd international symposium on fusion nuclear technology, Los Angeles, CA (United States), 27 Jun - 1 jul 1994). Order Number DE94016311. Source: OSTI; NTIS; INIS; GPO Dep.

The behavior of divertor materials during a major disruption in ITER is very important to successful and reliable operation of the reactor. Erosion of material surfaces due to a thermal energy dump can severely limit the lifetimes of plasma-facing components and thus diminish the reactor's economic feasibility. A recently developed comprehensive numerical model has been enhanced and used in this analysis, which includes all major physical processes taking place during plasma/material interactions. Models to account for material thermal evolution, plasma/vapor interaction physics, and models for hydrodynamic radiation transport in the developed vapor cloud are implemented in a self-consistent manner to realistically assess disruption damage. The extent of self-protection from the developed vapor cloud in front of the incoming plasma particles is critically important in determining the overall disruption lifetime. Models to study detailed effects of the strong magnetic field on the behavior of the vapor cloud and on the net erosion rate have been developed and analyzed. Candidate materials such as beryllium and carbon are both considered in this analysis. The dependence of divertor disruption lifetime on disruption physics and reactor conditions was analyzed and discussed.

28850 (ANL/TD/CP–82097) **Recent designs for advanced fusion reactor blankets.** Sze, D.K. (Argonne National Lab., IL (United States). Fusion Power Program). Argonne National Lab., IL (United States). Jun 1994. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-940630–25: 11. topical meeting on the technology of fusion energy, New Orleans, LA (United States), 19-24 Jun 1994). Order Number DE94015025. Source: OSTI; NTIS; INIS; GPO Dep.

A series of reactor design studies based on the Tokamak configuration have been carried out under the direction of Professor Robert Conn of UCLA. They are called ARIES-1 through 4 and PULSAR 1 and 2. The key mission of these studies is to evaluate the attractiveness of fusion assuming different degrees of advancement in either physics or engineering development. Also, the requirements of engineering and physics systems for a pulsed reactor were evaluated by the PULSAR design studies. This paper discusses the directions and conclusions of the blanket and related engineering systems for those design studies.

28851 (DOE/ER/53198–242) **Solid target boronization of the MST reversed-field pinch during pulsed discharge cleaning.** Den Hartog, D.J. (Univ. of Wisconsin, Madison, WI (United States). Dept. of Physics); Kendrick, R.D. Wisconsin Univ., Madison, WI (United States). Plasma Physics Research. Jun 1994. 14p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-85ER53198. (CONF-940580–7: 11. international conference on plasma surface interactions in controlled fusion devices, Mito (Japan), 23-27 May 1994). Order Number DE94015535. Source: OSTI; NTIS; INIS; GPO Dep.

A solid rod of hot-pressed boron carbide is currently being used as the source of boron during boronization of MST. In previous work the authors have demonstrated that boronization can be effectively accomplished by insertion of a low apparent density B_4C rod into the edge hydrogen plasma of normal high-power RFP discharges. The authors have now extended that technique and can boronize MST by inserting a negatively biased B_4C rod into pulsed discharge cleaning (PDC) helium plasmas. The same positive results of reduced impurity contamination and particle reflux are achieved with this new boronization method. The bias for the target is provided by the ohmic heating transformer which is pulsed to produce the PDC discharges. Current flow through the B_4C rod is limited by an inductor. The amount of hydrogen in the amorphous boron carbide films is minimal because the only hydrogen in the PDC plasma is that left over from RFP discharges.

28852 (DOE/ER/53198–243) **Fluctuation measurements at c/ω_{pe} spatial scales in a tokamak.** Haines, E.J.; Tan, I.H.; Prager, S.C. Wisconsin Univ., Madison, WI (United States). Plasma Physics Research. Jul 1994. 34p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-85ER53198. Order Number DE94016771. Source: OSTI; NTIS; INIS; GPO Dep.

Magnetic and electrostatic fluctuations have been measured at the short scale length of the collisionless skin depth (c/ω_{pe} using small magnetic and electrostatic probes in the Tokapole II tokamak. For certain conditions and at high frequency (MHz range) the amplitude is observed to increase as wavelength is decreased toward the c/ω_{pe} scale. Wavelength dependence is inferred from measurements with probes of varying sizes. The amplitude of the turbulence at the c/ω_{pe} scale is smaller than the dominant low frequency turbulence, and is thus not relevant to transport in Tokapole II. Comparison with theoretical treatments of c/ω_{pe} turbulence is discussed.

28853 (DOE/ER/53198–244) **Conservation of magnetic helicity during plasma relaxation.** Ji, H.; Prager, S.C.; Sarff, J.S. Wisconsin Univ., Madison, WI (United States). Plasma Physics Research. Jul 1994. 19p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-85ER53198. Order Number DE94016770. Source: OSTI; NTIS; INIS; GPO Dep.

Decay of the total magnetic helicity during the sawtooth relaxation in the MST Reversed-Field Pinch is much larger than the MHD prediction. However, the helicity decay (3–4%) is smaller than the magnetic energy decay (7–9%), modestly supportive of the helicity conservation hypothesis in Taylor's relaxation theory. Enhanced fluctuation-induced helicity transport during the relaxation is observed.

28854 (DOE/ER/54160–1-Vol.3, pp. 1520-1525) **Cyclotron autoresonance masers: Recent experiments and projects.** Bratman, V.L. (Institute of Applied Physics, Novgorod (Russian Federation)); Denisov, G.G.; Samsonov, S.V. Maryland Univ., College Park, MD (United States). [1992]. (CONF-920515–Vol.3: 9. international conference on high power particle beams, Washington, DC (United States), 25-29 May 1992). In *Beams 92: Proceedings: Volume 3, Microwaves, Free electron lasers, Advanced accelerators, Applications, and Plasma discharges.* 681p. Order Number DE94014785. Source: OSTI; NTIS; INIS.

The cyclotron autoresonance maser (CARM) is one of the promising modifications of free-electron masers (FEM) operated at the millimeter and submillimeter waves. In this range CARM requires particle energies significantly lower than for the ubitron, and magnetic fields smaller than those for the gyrotron. The CARM is considered as a possible source of coherent millimeter wavelength radiation with large average (continuous) power for plasma heating in controlled fusion devices.

28855 (DOE/ER/54160–1-Vol.3, pp. 1895-1900) **Focusing and propagation of proton beam as driver of ICF.** Niu, Keishiro (Teikyo Univ. of Technology, Chiba (Japan)). Maryland Univ., College Park, MD (United States). [1992]. (CONF-920515–Vol.3: 9. international conference on high power particle beams, Washington, DC (United States), 25-29 May 1992). In *Beams 92: Proceedings: Volume 3, Microwaves, Free electron lasers, Advanced accelerators, Applications, and Plasma discharges.* 681p. Order Number DE94014785. Source: OSTI; NTIS; INIS.

It is the aim of this paper to design a fusion power plant whose electric output power is 1GW, and to find a way for breaking through fusion technically and energy-economically. Proton beams, whose total energy is 12MJ, pulse width is 30ns and beam number

is 6, are chosen here as the energy driver. Because of low quality of proton beams, the target should be indirect driven and its radius should be large. The target with the radius of 8.7 mm is the spherical cryogenic hollow one, which has double shells and five layers. The reactor has double solid walls. The inner wall rotates around the axis to induce a centrifugal acceleration. Flibe as the coolant protects the solid walls from damage and breeds tritium. The key technology of this power plant is for beam focusing and beam propagation. To suppress the beam divergence by the electrostatic force due to unneutralized proton charge, the simultaneous electron beam launching is proposed. When the excess electron beam current is -50kA, the induced magnetic field in the azimuthal direction confines the beam in the radius of 5 mm, provided that the beam path is covered by the metal guide whose radius is 1 cm.

28856 (DOE/ER/54160–1-Vol.3, pp. 1901-1906) **LIBRA-LITE, a ballistic focus light ion inertial confinement fusion reactor.** Peterson, R.R. (Univ. of Wisconsin, Madison, WI (United States)); Bruggink, D.; Engelstad, R.L.; Kulcinski, G.L.; Lovell, E.G.; MacFarlane, J.J.; Mogahed, E.A.; Moses, G.A.; Rutledge, S.; Sawan, M.E. Maryland Univ., College Park, MD (United States). [1992]. (CONF-920515–Vol.3: 9. international conference on high power particle beams, Washington, DC (United States), 25-29 May 1992). In *Beams 92: Proceedings: Volume 3, Microwaves, Free electron lasers, Advanced accelerators, Applications, and Plasma discharges.* 681p. Order Number DE94014785. Source: OSTI; NTIS; INIS.

Ballistic propagation of ions in a light ion Inertial Confinement Fusion (ICF) reactor has potential advantages over propagation using plasma channels, but it requires that focusing magnets be close to the target. Ballistic transport is simpler and potentially more efficient, but limits on the ion microdivergence make a small focal spot and a large focal length simultaneously impossible. Target ignition requires a beam intensity above some minimum value, assumed to be 127 TW/cm^2. To achieve this intensity, one adjusts the total beam energy, the positions of the focusing magnets, the microdivergence of the ion beam, and the time of flight bunching of the beam. LIBRA-LITE is a 1000 MWe power plant design consistent with ballistic ion focusing, where these parameters have been optimized.

28857 (DOE/ER/54160–1-Vol.3, pp. 1930-1934) **Large-aperture e-beam pumped excimer lasers for ICF.** Bolshakov, E.P. (D.V. Efremov Institute of Electrophysical Apparatus, St. Petersburg (Russian Federation)); Burtsev, V.A.; Vasilevsky, M.A.; Vodovosov, V.M.; Jeremkin, V.V.; Kuznetsov, V.E.; Ovsyannikov, V.A.; Pechersky, O.P.; Prokopenko, V.F.; Fidelskaya,Maryland Univ., College Park, MD (United States). [1992]. (CONF-920515–Vol.3: 9. international conference on high power particle beams, Washington, DC (United States), 25-29 May 1992). In *Beams 92: Proceedings: Volume 3, Microwaves, Free electron lasers, Advanced accelerators, Applications, and Plasma discharges.* 681p. Order Number DE94014785. Source: OSTI; NTIS; INIS.

The design of a unified large-aperture final amplifier taken as a base of an excimer channel for laser drivers is described. According to calculations it can yield in long pulse generation the laser output up to 20 kJ under using Ar-Kr-F_2 mixture at pressure P = 1.4 atm. Also, the results, obtained at testing of the model excimer lasers pumped by contrary e-beams "Lira-1M" and "Lira-01" with 1 and 0.1 kJ output energy respectively are reported.

28858 (DOE/ER/54160–1-Vol.3, pp. 1979-1983) **Electrothermal plasma source as a high heat flux simulator for plasma-facing components and launch technology studies.** Bourham, M. (North Carolina State Univ., Raleigh, NC (United States)); Gilligan, J.; Hankins, O.; Eddy, W.; Hurley, J. Maryland Univ., College Park, MD (United States). [1992]. Contract DASG60-90-C-0028; Contract DAAL03-86-G-0157; Contract D (CONF-920515–Vol.3: 9. international conference on high power particle beams, Washington, DC (United States), 25-29 May 1992). In *Beams 92: Proceedings: Volume 3, Microwaves, Free electron lasers, Advanced accelerators, Applications, and Plasma discharges.* 681p. Order Number DE94014785. Source: OSTI; NTIS; INIS.

An electrothermal plasma source "SIRENS" has been designed, constructed, and operated (over 450 shots) to produce high density ($> 10^{25}$/m^3), low temperature (1-3 eV) plasma formed by the ablation of the insulator (Lexan, $C_{16}H_{14}O_3$) with currents of up to 100 kA and energies up to 15 kJ. Switchable capacitor modules allow for higher energy inputs (30 kJ) and longer pulse lengths (0.1 - 1.0 ms with pulse forming network). The plasma flows through a cylindrical barrel, situated along the axis of a pulsed magnet, which can produce a parallel magnetic field (up to 16 T) over 8 msec pulse length. The source heat flux (up to 90 GW/m^2 over 100 μsec pulse) and the diagnostics arrangements (electrical, magnetic, optical, heat flux, pressure, materials) are adequate for various applications (plasma-matter interaction; simulation of thermal quench phase of plasma disruption in fusion tokamaks; simulation of pulsed heat loading conditions of plasma-driven launchers; ablation-controlled arcs; plasma switchers). Different materials (metals, alloys, coated materials, insulators and graphite grades) have been exposed to the high heat flux in SIRENS, where comparative erosion behavior was obtained. Vapor shield phenomena has been characterized for different materials, and the energy transmission factor through the shielding layer is obtained. The magnetic field is produced parallel to the surface to cause a decrease in the turbulent energy transport through the vapor shield to provide further reduction of the surface erosion (magnetic vapor shield effect).

28859 (DOE/ER/54181–2) **Development of radiation-hardened ceramic composites for fusion applications: Technical progress report, September 1, 1993–August 31, 1994.** Osborne, M.C. (Rensselaer Polytechnic Institute, Troy, NY (United States)); Steiner, D.; Snead, L.L. Rensselaer Polytechnic Inst., Troy, NY (United States). Dept. of Nuclear Engineering and Engineering Physics. May 1994. 18p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-92ER54181. Order Number DE94016182. Source: OSTI; NTIS; INIS; GPO Dep.

The strength and toughness of continuous fiber reinforced ceramic composites (CFCC) are highly dependent on the fiber strength distribution. To first order, weaker fibers lead to low strength but higher toughness while stronger fibers lead to high strength composites of relatively low toughness. Toughness is associated with pullout of the fibers from the ceramic matrix. It has been shown previously that both strength and toughness of SiC/Nicalon^{TM} composites are drastically changed following irradiation. This paper will present and discuss results for low oxygen Nicalon fibers irradiated at three damage levels; 0.013 dpa, 0.13 dpa, and 0.32 dpa. Single fibers were tensile tested and analyzed, using Weibull statistics, for mean strength and distribution. Tensile modulus was also determined. Using a diffractometer, the fiber grain size and percent crystallinity were determined. The initial results of these low level neutron irradiations exhibit no substantial degradation of the properties investigated. Therefore, continued research at higher doses is recommended.

28860 (ECN-I–93-057) **Thermal effects of runaway electrons in an armoured divertor.** Stad, R.C.L. van der. Netherlands Energy Research Foundation (ECN), Petten (Netherlands). Dec 1993. 28p. Order Number DE94789659. Source: OSTI; NTIS; INIS.

This report describes the results of a numerical thermal analysis of the heat deposition of runaway electrons accompanying plasma disruptions in a armoured divertor. The divertor concepts studied are carbon on molybdenum and beryllium on copper. The conclusion is that the runaway electrons can cause melting of the armour as well as melting of the structure and can damage the divertor severely. (orig.)

28861 (ECN-R–94-003) **Three loss-of-coolant accidents in the first wall/blanket cooling system of the SEAFP alternative plant model.** Komen, E.M.J.; Koning, H. Netherlands Energy Research Foundation (ECN), Petten (Netherlands). Mar 1994. 104p. Order Number DE94785925. Source: OSTI; NTIS; INIS.

This report presents the thermal-hydraulic analysis of three ex-vessel Loss-of-Coolant Accidents (LOCAs) in the first wall/blanket cooling system of the alternative SEAFP reactor design. The LOCAs are caused by a rupture of the pump suction pipe, an inlet header, and an outlet header respectively. The ex-vessel LOCAs considered result from a rupture of a cooling pipe located outside the plasma vessel. In order to determine the worst case LOCA conditions, no plasma shutdown and no other counteractions have been assumed. The analyses have been performed using the

thermal-hydraulic system analysis code RELAP5/MOD3. Special attention has been paid to the transient thermal-hydraulic behaviour of the cooling system and the temperature development in the first wall and blanket. For the LOCAs considered, the temperature development in the first wall is more critical than the temperature development in the blanket. In the LOCA caused by a rupture of the pump suction pipe, melting at the midplane of the outboard first wall starts about 56 s after break initiation. In the LOCA caused by a rupture of an inlet header, melting at the midplane of the outboard first wall starts about 62 s after break initiation, whereas in the LOCA caused by a rupture of an outlet header melting at the midplane of the outboard first wall starts about 74 s after break initiation. (orig.)

28862 (EGG–1183-4118) **Mirror Fusion Test Facility: Superconducting magnet system cost analysis.** EG and G, Inc., San Ramon, CA (United States). San Ramon Operations. Jul 1977. 288p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC08-76NV01183. Order Number DE94016528. Source: OSTI; NTIS; GPO Dep.

At the request of Victor Karpenko, Project manager for LLL's Mirror Fusion Test Facility, EG&G has prepared this independent cost analysis for the proposed MFTF Superconducting Magnet System. The analysis has attempted to show sufficient detail to provide adequate definition for a basis of estimating costs.

28863 (EGG–1183-4119) **MFTF: Mirror Fusion Test Facility, Vacuum vessel cost analysis.** Altes, R.; Bevers, T.; Garcia, J. EG and G Energy Measurements, Inc., San Ramon, CA (United States). San Ramon Operations. Jul 1977. 132p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC08-76NV01183. Order Number DE94015387. Source: OSTI; NTIS; GPO Dep.

At the request of Victor Karpenko, Project Manager for LLL's Mirror Fusion Test Facility (MFTF), EG&G, Inc., has prepared this independent cost and schedule analysis for the proposed MFTF Vacuum Vessel. Gerald Dittman, LLL Project Engineer for the MFTF vacuum vessel system, and Wayne Pollard, LLL Staff Engineer, collaborated with EG&G and provided the vacuum vessel requirements. EG&G's analysis has attempted to show sufficient detail to provide adequate definition for estimating cost.

28864 (GA-A–21679) **Divertor bias experiments: General Atomics Project 3466.** Staebler, G.M. General Atomics, San Diego, CA (United States). Jun 1994. 37p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-89ER51114. (CONF-940580–8: 11. international conference on plasma surface interactions in controlled fusion devices, Mito (Japan), 23-27 May 1994). Order Number DE94015720. Source: OSTI; NTIS; INIS; GPO Dep.

Electrical biasing of the divertor target plates has recently been implemented on several tokamaks. The results of these experiments to date will be reviewed in this paper. The bias electrode configuration is unique in each experiment. The effects of biasing on the scrape-off layer (SOL) plasma also differ. By comparing results between machines, and using theoretical models, an understanding of the basic physics of biasing begins to emerge. Divertor biasing has been demonstrated to have a strong influence on the particle and energy transport within the SOL. The ability to externally control the SOL plasma with biasing has promising applications to future tokamak reactors.

28865 (GA-A–21705) **Effect of low density H-mode operation on edge and divertor plasma parameters.** Maingi, R. (Oak Ridge Associated Universities, Inc., TN (United States)); Mioduszewski, P.K.; Cuthbertson, J.W. General Atomics, San Diego, CA (United States); Oak Ridge National Lab., TN (United States); Lawrence Livermore National Lab., CA (United States). Jul 1994. 18p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-89ER51114 ; AC05-84OR21400 ; W-7405-ENG-48. (CONF-940580–10: 11. international conference on plasma surface interactions in controlled fusion devices, Mito (Japan), 23-27 May 1994). Order Number DE94016521. Source: OSTI; NTIS; INIS; GPO Dep.

We present a study of the impact of H-mode operation at low density on divertor plasma parameters on the DIII-D tokamak. The line-average density in H-mode was scanned by variation of the particle exhaust rate, using the recently installed divertor cryocondensation pump. The maximum decrease (50%) in line-average electron density was accompanied by a factor of 2 increase in the edge electron temperature, and 10% and 20% reductions in the measured core and divertor radiated power, respectively. The measured total power to the inboard divertor target increased by a factor of 3, with the major contribution coming from a factor of 5 increase in the peak heat flux very close to the inner strike point. The measured increase in power at the inboard divertor target was approximately equal to the measured decrease in core and divertor radiation.

28866 (JAERI-M–94-048) **Simulation study of tapered FEL amplifiers in Raman and Compton regimes.** Takahashi, Mayuko (Saitama Univ. Urawa (Japan)); Kawasaki, Sunao; Sakamoto, Keishi; Watanabe, Akihiko; Kishimoto, Yasuaki; Shiho, Makoto. Japan Atomic Energy Research Inst., Tokyo (Japan). Mar 1994. 139p. (In Japanese). Order Number DE94785266. Source: OSTI; NTIS; INIS.

The magnetic taper of the wiggler field was studied numerically for an efficiency enhancement of mm wave free electron laser using the 3 dimensional analysis code. The linear taper seems effective to obtain an effective energy conversion. As the total conversion ratio increase as the K parameter increase, the large value of K parameter should be designed for high efficiency FEL. Prior to the simulation, the energy and its spread of the electron beam E_{sp} were measured experimentally at the JAERI mm wave FEL (LAX-1). As a result, E_{sp} = 15 keV at the beam energy of induction linac of 820 keV, which support that the JAERI FEL was operated at the Raman regime. (author).

28867 (JAERI-M–94-072) **Design study of a negative-ion based NBI system for JT-60U.** Akino, Noboru (Japan Atomic Energy Research Inst., Naka, Ibaraki (Japan). Naka Fusion Research Establishment); Araki, Masanori; Ebisawa, Noboru. Japan Atomic Energy Research Inst., Tokyo (Japan). Mar 1994. 431p. (In Japanese). Order Number DE94785265. Source: OSTI; NTIS; INIS.

A high energy negative-ion based NBI system for JT-60U has been designed. The objective of the NBI system is to demonstrate mega-ampere level NB current drive and plasma core heating in a reactor-grade high density plasma. This is the first negative-ion based NBI system in the world. The required specifications of the NBI system are; a beam energy of 500 keV, an injection power of 10 MW, a beam pulse duration of 10 sec with a duty cycle of 1/60 and a beam species of deuterium or hydrogen. The neutral beam power of 10 MW is injected tangentially using one beam-line with two large negative-ion sources. The construction of the NBI system has been started, and will be operational in 1996. (author).

28868 (KFK–5298) **Numerical analysis of mode conversion in coaxial waveguide components.** Hoechtl, O. Kernforschungszentrum Karlsruhe GmbH (Germany). Projekt Kernfusion; Kernforschungszentrum Karlsruhe GmbH (Germany). Inst. fuer Technische Physik. Feb 1994. 86p. (In German). Order Number DE94785971. Source: OSTI; NTIS (US Sales Only); INIS.

Based on a diploma-thesis submitted to Universitaet Karlsruhe (T.H.) (DE). Inst. fuer Hoechstfrequenztechnik und Elektronik.

An existing scattering matrix code for circular waveguides has been modified to include coaxial geometries. Starting with the analytical description by means of eigenwaves the mode coupling at a single waveguide step has been determined. The coupling between circular-circular, coaxial-coaxial and circular-coaxial waveguides is investigated. By using the scattering matrix formulation it is possible to combine several waveguide discontinuities which allows the approximation of a continuous radius variation. The work concludes with the application to some problems. In particular the mode purity of coaxial waveguide tapers, planned to be installed in gyrotrons with coaxial resonators, has been studied. In addition a converter between the TEM- and the $TM_{0,1}$-mode has been optimized and the results have been compared to measurement. (orig./HP)

28869 (LA–12773) **Generation of ultra-high magnetic fields for AGEX.** Sheppard, M.G.; Fowler, C.M.; Freeman, B.L. Los Alamos National Lab., NM (United States). Aug 1994. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract

W-7405-ENG-36. Order Number DE94015171. Source: OSTI; NTIS; GPO Dep.

Generation of ultra-high magnetic fields of 10-25 MG (0.4-2.5 MJ/cm^3) using high-explosive-driven magnetic flux-compression is one approach which could enhance the US Above Ground EXperimental (AGEX) capability. The beginnings of a US-Russian collaboration to generate 20 MG by extending flux-compression technology are described. The first joint experiments, planned for November 1993 at Los Alamos, will test the Russian MC-1 10 MG generator and will be followed by several high-temperature superconductor experiments. Equation-of-state experiments involving isentropic compression at pressures of several megabars are being considered as follow-on joint experiments. Magnetohydrodynamic (MHD) calculations of the MC-1 experiments using the ID MHD code RAVEN are presented, including comparisons and benchmarks against previous Russian experiments and calculations. The first joint experiments will use Russian hardware and US high-explosive. Gaining practical experience with the MC-1 and benchmarking the RAVEN predictions for the performance of the modified generator are important first steps towards reaching the 20 MG goal.

28870 (LA-UR–94-2107) **Loads for pulsed power cylindrical implosion experiments.** Anderson, W.E. (and others); Armijo, E.V.; Barthell, B.L.; Bartos, J.J.; Bush, H.; Foreman, L.R.; Garcia, F.P.; Gobby, P.L.; Gomez, V.M.; Gurule, V.A. Los Alamos National Lab., NM (United States). [1994]. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-9406197–1: American Nuclear Society meeting, La Grange Park, IL (United States), 19-24 Jun 1994). Order Number DE94014429. Source: OSTI; NTIS; GPO Dep.

Pulse power can be used to generate high energy density conditions in convergent hollow cylindrical geometry through the use of appropriate electrode configuration and cylindrical loads. Cylindrically symmetric experiments are conducted with the Pegasus-H inductive store, capacitor energized pulse power facility at Los Alamos using both precision machined cylindrical liner loads and low mass vapor deposited cylindrical foil loads. The liner experiments investigate solid density hydrodynamic topics. Foil loads vaporize from Joule heating to generate an imploding cylindrical plasma which can be used to simulate some fluxes associated with fusion energy processes. Similar experiments are conducted with "Procyon" inductive store pulse power assemblies energized by explosively driven magnetic flux compression.

28871 (LA-UR–94-2268) **Radiation rates for low Z impurities in edge plasmas.** Clark, R. (Los Alamos National Lab., NM (United States)); Abdallah, J.; Post, D. Los Alamos National Lab., NM (United States). [1994]. 13p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-940580–12: 11. international conference on plasma surface interactions in controlled fusion devices, Mito (Japan), 23-27 May 1994). Order Number DE94016073. Source: OSTI; NTIS; INIS; GPO Dep.

The potential role of impurity radiation in the reduction of heat loads on divertor plates places a new degree of importance on the accuracy of low Z impurity radiation emission rates for electron temperatures below 300 eV. We have calculated the radiated power loss using a collisional-radiative model for Be, B, C, Ne and Ar using a multiple configuration interaction model which includes density dependent effects, as well as a very detailed treatment of the energy levels and meta-stables. These rates indicate that significant enhancements above steady state collisional-radiative rates due to such effects as rapid recycling and charge exchange recombination will be necessary for impurity radiation to reduce the peak heat loads on divertor plates for high heat flux experiments such as ITER.

28872 (LA-UR–94-2563) **Radioactivity measurements of ITER materials using the TFTR D-T neutron field.** Kumar, A. (California Univ., Los Angeles, CA (United States). School of Engineering and Applied Science); Abdou, M.A.; Barnes, C.W.; Kugel, H.W.; Loughlin, M.J. Los Alamos National Lab., NM (United States). [1994]. 30p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36 ; AC02-76CH03073 ; FG03-86ER52123. (CONF-940664–22: ISFNT-3: 3rd international symposium on fusion nuclear technology, Los Angeles, CA (United States), 27 Jun - 1 jul 1994). Order Number DE94016094. Source: OSTI; NTIS; INIS; GPO Dep.

The availability of high D-T fusion neutron yields at TFTR has provided a useful opportunity to directly measure D-T neutron-induced radioactivity in a realistic tokamak fusion reactor environment for materials of vital interest to ITER. These measurements are valuable for characterizing radioactivity in various ITER candidate materials. for validating complex neutron transport calculations, and for meeting fusion reactor licensing requirements. The radioactivity measurements at TFTR involve potential ITER materials including stainless steel 316, vanadium, titanium, chromium, silicon, iron, cobalt, nickel, molybdenum, aluminum, copper, zinc. zirconium, niobium, and tungsten. Small samples of these materials were irradiated close to the plasma and just outside the vacuum vessel wall of TFTR, locations of different neutron energy spectra. Saturation activities for both threshold and capture reactions were measured. Data from dosimetric reactions have been used to obtain preliminary neutron energy spectra. Spectra from the first wall were compared to calculations from ITER and to measurements from accelerator-based tests.

28873 (PNL-SA–24165) **Microstructure and density changes of LI2O during irradiation in BEATRIX-II, Phase 1.** Takahashi, T. (Japan Atomic Energy Research Inst., Tokai, Ibaraki (Japan)); Noda, K.; Slagle, O.D.; Hobbs, F.D. Pacific Northwest Lab., Richland, WA (United States). Jun 1994. 16p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. (CONF-940664–20: ISFNT-3: 3rd international symposium on fusion nuclear technology, Los Angeles, CA (United States), 27 Jun - 1 jul 1994). Order Number DE94015195. Source: OSTI; NTIS; INIS; GPO Dep.

BEATRIX-II, Phase 1 was an in situ tritium recovery experiment carried out on Li_2O to lithium burnups in excess of 4%. Solid Li_2O specimens were irradiated under a temperature gradient in the range from 700 K at the outer diameter to 1,270 K at the center. A ring specimen of Li_2O operated at a nearly uniform temperature with the capability of changing temperature in the range from 780 to 920 K. Li_2O single crystals having two different ^6Li enrichments (0.07 and 1.8 at%) were irradiated at 650 K in nonvented canisters. Microstructures of these specimens, before and after irradiation, were investigated using optical and scanning electron microscopy. Substantial microstructure change was found to have occurred in the solid specimen during irradiation and this change was characterized by the development of large columnar grains, lenticular porosity and a center void. The development of columnar grains and the formation of the center void was attributed to the migration of lenticular pores up the thermal gradient by a vaporization/condensation process. Morphological changes on fracture surfaces were observed both for the polycrystalline (solid and ring) specimens and the single crystal specimens. Measurements of density were used to further characterize the effects of irradiation on the open and closed porosity distributions in all the specimens. Although extensive microstructural and density changes occurred during irradiation, these changes had no significant impact on the integrity of Li_2O during irradiation, and therefore these results support the use of Li_2O as fusion solid breeders.

28874 (PNL-SA–24206) **Experiments to examine the contribution of gas atoms to void formation in irradiated metals.** Shimomura, Y. (Hiroshima Univ., Higashi-Hiroshima (Japan). Faculty of Engineering); Mukoda, I.; Kiritani, M.; Kojima, S.; Garner, F.A. Pacific Northwest Lab., Richland, WA (United States). [1993]. 16p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. (CONF-9409176–1: 6. international conference on fusion reactor materials, Stressa (Italy), 27 Sep - 1 oct 1994). Order Number DE94015209. Source: OSTI; NTIS; INIS; GPO Dep.

Vacuum-melting has been employed to demonstrate that residual cases, especially hydrogen, strongly influence void nucleation of copper, copper binary alloys and various Fe-Cr-Ni base alloys during either neutron or electron irradiation. Void nucleation in nickel appears not to be strongly affected by residual gases, however. Solute-free and solute-bearing, Fe-Cr-Ni alloys appear to respond differently to differences in gas content. When contamination of

specimens with sodium occurs during neutron irradiation, void nucleation in both as fabricated and vacuum-melted specimens is similar, suggesting that gas atoms re-enter the specimens during irradiation.

28875 (PNL-SA–24433) **Tritium release behavior of SIBELIUS beryllium.** Baldwin, D.L. Pacific Northwest Lab., Richland, WA (United States). 9 Jun 1994. 17p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. (CONF-9406171–2: 3. international workshop on ceramic breeder blanket interactions, Los Angeles, CA (United States), 22-24 Jun 1994). Order Number DE94014999. Source: OSTI; NTIS; INIS; GPO Dep.

Tritium-release kinetics studies have been conducted on eight beryllium specimen disks, irradiated in the European Community/ United States of America (EC/USA) Collaborative SIBELIUS irradiation test. These studies, measuring tritium-release rate versus time over several temperatures, have generated a series of well-characterized tritium release curves. These release curves are presented, along with supporting information, to provide input data in support of tritium transport prediction models and code development.

28876 (PPPL-CFP–3082) **The engineering design of the Tokamak Physics Experiment.** Schmidt, J.A. Princeton Univ., NJ (United States). Plasma Physics Lab. [1994]. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH03073. (CONF-940630–26: 11. topical meeting on the technology of fusion energy, New Orleans, LA (United States), 19-24 Jun 1994). Order Number DE94014860. Source: OSTI; NTIS; INIS; GPO Dep.

A mission and supporting physics objectives have been developed, which establishes an important role for the Tokamak Physics Experiment (TPX) in developing the physic basis for a future fusion reactor. The design of TPX include advanced physics features, such as shaping and profile control, along with the capability of operating for very long pulses. The development of the superconducting magnets, actively cooled internal hardware, and remote maintenance will be an important technology contribution to future fusion projects, such as ITER. The Conceptual Design and Management Systems for TPX have been developed and reviewed, and the project is beginning Preliminary Design. If adequately funded the construction project should be completed in the year 2000.

28877 (PPPL-CFP–3091) **Real-time boronization in PBX-M using erosion of solid boronized targets.** Kugel, H.W. (and others); Timberlake, J.; Bell, R. Princeton Univ., NJ (United States). Plasma Physics Lab. [1994]. 16p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH03073. (CONF-940580–5: 11. international conference on plasma surface interactions in controlled fusion devices, Mito (Japan), 23-27 May 1994). Order Number DE94014855. Source: OSTI; NTIS; INIS; GPO Dep.

Thirty one real-time boronizations were applied to PBX-M using the plasma ablation of solid target probes. More than 17 g of boron was deposited in PBX-M using this technique. The probes were positioned at the edge plasma to optimize ablation and minimize spallation. Auger depth profile analysis of poloidal and toroidal deposition sample coupon arrays indicate that boron was transported by the plasma around the torus and deep into the divertors. During discharges with continuous real-time boronization, low-Z and high-Z impurities decreased rapidly as plasma surfaces were covered during the first 20–30 discharges. After boronization, a short-term improvement in plasma conditions persisted prior to significant boron erosion from plasma surfaces, and a longer term, but less significant, improvement persisted as boron farther from the edge continued gettering. Real-time solid target boronization has been found to be very effective for accelerating conditioning to new regimes and maintaining high performance plasma conditions.

28878 (SAND–93-3813C) **LEVIS ion source and beam characterization on PBFA-II.** Renk, T.J.; Tisone, G.C.; Adams, R.G.; Bailey, J.E.; Filuk, A.B.; Johnson, D.J.; Pointon, T.D. Sandia National Labs., Albuquerque, NM (United States). [1993]. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. (CONF-940634–12: 10. international conference on high power particle beams, San Diego, CA (United States), 20-24 Jun 1994). Order Number DE94015802. Source: OSTI; NTIS; INIS; GPO Dep.

We report on the continuing development of the LEVIS (Laser Evaporation Ion Source) lithium active ion source for the 15-cm radial focussing ion diode on PBFA-11. We found previously that DC-heating of the anode surface to 150°C maximum for 5 hours resulted in a pure lithium beam. This paper discusses the characterization of LEVIS source uniformity by Faraday cup arrays and multiple lines of sight for visible light spectroscopy. These diagnostics give some evidence of nonuniformity in both A-K gap electric fields and ion current density. Despite this, however, the measured focal spot size appears smaller than with a passive LiF source operated in the same magnetic field topology. Experiments using a curved anode for vertical beam focussing show reduced ion beam turn-on delay by 5 ns by altering the magnetic field topology as well as anode curvature. Another 3–5 ns reduction was achieved by switching from a passive LiF to the active LEVIS source.

28879 (UCRL-ID–117334) **Multi-unit inertial fusion plants based on HYLIFE-II, with shared heavy-ion RIA driver and target factory, producing electricity and hydrogen fuel.** Logan, G. (Lawrence Livermore National Lab., CA (United States)); Moir, R.; Hoffman, M. Lawrence Livermore National Lab., CA (United States). 5 May 1994. 36p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. Order Number DE94016009. Source: OSTI; NTIS; GPO Dep.

Following is a modification of the IFEFUEL systems code, called IFEFUEL2, to treat specifically the HYLIFE-II target chamber concept. The same improved Recirculating Induction Accelerator (RIA) energy scaling model developed recently by Bieri is used in this survey of the economics of multi-unit IFE plants producing both electricity and hydrogen fuel. Reference cases will assume conventional HI-indirect target gains for a 2 mm spot, and improved HYLIFE-II BoP models as per Hoffman. Credits for improved plant availability and lower operating costs due to HYLIFE-II's 30-yr target chamber lifetime are included, as well as unit cost reductions suggested by Delene to credit greater "learning curve" benefits for the duplicated portions of a multi-unit plant. To illustrate the potential impact of more advanced assumptions, additional "advanced" cases will consider the possible benefits of an MHD + Steam BoP, where direct MHD conversion of plasma from baseball-size LiH target blanket shells is assumed to be possible in a new (as yet undesigned) liquid Flibe-walled target chamber, together and separately, with advanced, higher-gain heavy-ion targets with Fast Ignitors. These runs may help decide the course of a possible future "HYLIFE-III" IFE study. Beam switchyard and final focusing system costs per target chamber are assumed to be consistent with single-sided illumination, for either "conventional" or "advanced" indirect target gain assumptions. Target costs are scaled according to the model by Woodworth. In all cases, the driver energy and rep rate for each chosen number of target chambers and total plant output will be optimized to minimize the cost of electricity (CoE) and the associated cost of hydrogen (CoH), using a relationship between CoE and CoH to be presented in the next section.

28880 (UCRL-JC–115599) **An x-ray technique for precision laser beam synchronization.** Landen, O.L.; Lerche, R.A.; Hay, R.G.; Hammel, B.A.; Kalantar, D.; Cable, M.D. Lawrence Livermore National Lab., CA (United States). 2 May 1994. 15p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-940552–18: 10. topical conference on high-temperature plasma diagnostics, Rochester, NY (United States), 8-12 May 1994). Order Number DE94016449. Source: OSTI; NTIS; INIS; GPO Dep.

A new x-ray technique for recording the relative arrival times of multiple laser beams at a common target with better than $\pm$ 10 ps accuracy has been implemented at the Nova laser facility. 100 ps, 3ω Nova beam are focused to separate locations on a gold ribbon target viewed from the side. The measurement consists of using well characterized re-entrant x-ray streak cameras for 1-dimensional streaked imaging of the $>$ 3 keV x-rays emanating from these isolated laser plasmas. After making the necessary correction for the differential laser, x-ray and electron transit times

involved, timing offsets as low as ± 7 ps are resolved, and on subsequent shots, corrected for, verified and independently checked. This level of synchronization proved critical in meeting the power balance requirements for indirectly-driven pulse-shaped Nova implosions.

28881 (UCRL-JC–117404) **Comparison of different statistical models of turbulence by similarity methods.** Cherfils, C. (Lawrence Livermore National Lab., CA (United States). Center for Advanced Fluid Dynamics Applications); Harrison, A.K. Lawrence Livermore National Lab., CA (United States). May 1994. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-940659–9: 1994 ASME (Americal Society of Mechanical Engineers) fluids engineering summer meeting, Lake Tahoe, NV (United States), 19-23 Jun 1994). Order Number DE94015326. Source: OSTI; NTIS; INIS; GPO Dep.

The process of implosion by inertial confinement is perturbed by hydrodynamic instabilities such as Rayleigh-Taylor, Richtmyer-Meshkov and Kelvin-Helmholtz instabilities. They may generate turbulent flow, causing the mixing of constituents and the degradation of the symmetry of the implosion. The authors extend Barenblatt's study (1983) of a one-equation turbulence model to a variety of two-equation models. They consider the problem of the propagation of incompressible turbulence generated by an instantaneous plane source, for which the evolution of the turbulence is determined completely by diffusive and dissipative processes. It is then possible to find for each model a self-similar solution asymptotic to the exact flow. The authors then compare the self-similar temporal and spatial behavior of several two-equation models, including the dependence on model coefficients. They also observe the predicted self-similar behavior and evaluate similarity exponents by numerical solution of the model equations. The combined analytic and numerical approach not only elucidates the analysis but also assists in the validation of the turbulence modeling codes. Some of this analysis has previously been carried out by one of the authors on two turbulence models (Cherfils, 1993), and related work has been reported by Neuvazhaev et al. (1991).

28882 (UCRL-JC–117470) **Design, operation, and application of the LLNL Portable Tritium Processing System.** Reitz, T.C.; Smuda, P.A.; Benapfl, M.A. Lawrence Livermore National Lab., CA (United States). Jun 1994. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-940630–27: 11. topical meeting on the technology of fusion energy, New Orleans, LA (United States), 19-24 Jun 1994). Order Number DE94015189. Source: OSTI; NTIS; INIS; GPO Dep.

A Portable Tritium Processing System (PTPS) has been developed at LLNL that could be applied to fusion energy related tritium processing and decontamination operations. The PTPS has four basic capabilities. These are: oil-free pumping, oil-free gas transfer, gas analysis, and gas phase tritium scrubbing. The design of the PTPS takes into consideration today's stringent release requirements, and utilizes secondary containment throughout the system. Because the system is portable, it can provide complete stand alone tritium processing, and can pass through a typical 36 inch laboratory door, and into confined spaces. This system can easily be moved to different locations within a facility such that the single tritium processing system can provide close-coupled support to multiple operations. Typical setup time for the PTPS is approximately two weeks. The PTPS has been in operation at LLNL for approximately one year. During this time, gram quantities of tritium have been successfully processed through the system. Releases to the stack attributable directly to the PTPS have been less than 0.1 curies, with most of this quantity being a product of maintenance operations.

28883 (UCRL-LR–117409) **Time-resolved electron thermal conduction by probing of plasma formation in transparent solids with high power subpicosecond laser pulses.** Vu, B.T.V. Lawrence Livermore National Lab., CA (United States). Feb 1994. 170p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. Order Number DE94015170. Source: OSTI; NTIS; INIS; GPO Dep.

This dissertation work includes a series of experimental measurements in a search for better understanding of high temperature (10^4-10^6K) and high density plasmas (10^{22}-10^{24}cm^{-3}) produced by irradiating a transparent solid target with high intensity (10^{13} - 10^{15}W/cm^2) and subpicosecond (10^{-12}-10^{-13}s) laser pulses. Experimentally, pump and probe schemes with both frontside (vacuum-plasma side) and backside (plasma-bulk material side) probes are used to excite and interrogate or probe the plasma evolution, thereby providing useful insights into the plasma formation mechanisms. A series of different experiments has been carried out so as to characterize plasma parameters and the importance of various nonlinear processes. Experimental evidence shows that electron thermal conduction is supersonic in a time scale of the first picosecond after laser irradiation, so fast that it was often left unresolved in the past. The experimental results from frontside probing demonstrate that upon irradiation with a strong (pump) laser pulse, a thin high temperature (~40eV) super-critical density (~10^{23}/cm^3) plasma layer is quickly formed at the target surface which in turn becomes strongly reflective and prevents further transmission of the remainder of the laser pulse. In the bulk region behind the surface, it is also found that a large sub-critical (~10^{18}/cm^3) plasma is produced by inverse Bremsstrahlung absorption and collisional ionization. The bulk underdense plasma is evidenced by large absorption of the backside probe light. A simple and analytical model, modified from the avalanche model, for plasma evolution in transparent materials is proposed to explain the experimental results. Elimination of the bulk plasma is then experimentally illustrated by using targets overcoated with highly absorptive films.

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28884 (DOE/BP–2289) **Journey of the Oncorhynchus: A story of the Pacific Northwest salmon.** USDOE Bonneville Power Administration, Portland, OR (United States). Jun 1994. 25p. Sponsored by USDOE, Washington, DC (United States). Order Number DE94015994. Source: OSTI; NTIS; GPO Dep.

This report tells the story of the Pacific Northwest salmon in words that children can understand. The life cycle of chinook salmon is depicted through pictures and elementary language from the egg to juvenile fish in fresh water, to maturing fish in the ocean, and the adults migrating back up to spawning grounds in the Columbia River. This can be very useful in the education of children.

28885 (LA-UR–94-1791) **Shifting our focus: Communicating science to a new, nontechnical culture.** Garnett, A.; Hollen, G.; Longshore, A.; Mauzy, A.; Reeves, A. Los Alamos National Lab., NM (United States). [1994]. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-9409164–1: IPCC conference, Banff (Canada), Sep 1994). Order Number DE94014258. Source: OSTI; NTIS; GPO Dep.

Congress' decision to close down the $11 billion Superconducting Supercollider is spreading anxiety throughout the scientific community. As funding for the nation's research laboratories becomes increasingly scarce, technical communicators in these organizations must focus much of their communications efforts on a new culture: Congress and the public. We discuss how to characterize this new audience and the importance of evaluating communication products, and we highlight some strategies for interpreting science to nonscientists more effectively.

28886 (SAND–89-0217) **Acronyms, initialisms, and abbreviations: Fourth Revision.** Tolman, B.J. (comp.). Sandia National Labs., Albuquerque, NM (United States). Apr 1994. 132p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. Order Number DE94016686. Source: OSTI; NTIS; GPO Dep.

This document lists acronyms used in technical writing. The immense list is supplemented by an appendix containing chemical elements, classified information access, common abbreviations used for functions, conversion factors for selected SI units, a flowcharting template, greek alphabet, metrix terminology, proofreader's marks, signs and symbols, and state abbreviations.

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Refer also to citation(s) 27504

28887 (DOE-EM-STD–5502-94) **Hazard baseline documentation.** USDOE, Washington, DC (United States). Aug 1994. 26p. Sponsored by USDOE, Washington, DC (United States). Order Number DE94016623. Source: OSTI; NTIS; GPO Dep.

This DOE limited technical standard establishes uniform Office of Environmental Management (EM) guidance on hazards baseline documents that identify and control radiological and nonradiological hazards for all EM facilities. It provides a road map to the safety and health hazard identification and control requirements contained in the Department's orders and provides EM guidance on the applicability and integration of these requirements. This includes a definition of four classes of facilities (nuclear, non-nuclear, radiological, and other industrial); the thresholds for facility hazard classification; and applicable safety and health hazard identification, controls, and documentation. The standard applies to the classification, development, review, and approval of hazard identification and control documentation for EM facilities.

28888 (DOE/OR/00033–T589) **Science/Engineering Education Division assessment activities: An overview: Annual report, FY 1993.** Oak Ridge Inst. for Science and Education, TN (United States). Feb 1994. 23p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-76OR00033. Order Number DE94015957. Source: OSTI; NTIS; GPO Dep.

Evaluation and assessment of employment trends and education programs are important functions of the Science/Engineering Education Division (SEED). Objectives of SEED's evaluation and assessment activities are to provide quantitative measures of the impact of programs on participants; assess programmatic achievements; provide valuable information for continued program operation; ensure that the programs meet their objectives; develop and maintain data bases on scientific and engineering employment and education; provide information about trends in employment and education for energy-related scientists and engineers; and provide analyses of energy-related science and engineering employment requirements, future labor market trends, adequacy of supply of new graduates, and implications for education programs. Whenever possible, data are collected that are consistent with information obtained by other national surveys to facilitate comparisons to national norms.

28889 (DOE-STD–1070-94) **Guidelines for evaluation of nuclear facility training programs.** USDOE, Washington, DC (United States). Jun 1994. 47p. Sponsored by USDOE, Washington, DC (United States). Order Number DE94015536. Source: OSTI; NTIS; GPO Dep.

This document establishes a single set of objectives and criteria for the evaluation of training programs developed to meet requirements of DOE Orders 5480.18A and 5480.20, and other directives that address training and qualification. The evaluation includes appraisals, surveillances, audits, reviews, assessments, and other activities intended to evaluate training. The standard is intended to assist personnel in performing evaluations of training and qualification programs.

28890 (EDF-DER-RA–1993-2) **Main facts 1993.** Electricite de France (EDF), 92 - Clamart (France). 1994. 127p. (In French). Order Number DE94632954. Source: OSTI; NTIS (US Sales Only); INIS.

This report presents the main facts of the studies carried out by the Direction des Etudes et Recherches (DER) of Electricite de France: new applications of electricity, classical and nuclear thermal power plants, electrical equipment, environment protection, network analysis, information and informatic equipment.

28891 (INIS-JP–024) **Proceedings of the 21st Japan conference on radiation and radioisotopes: The 100th year since the discovery of X-ray, and expectation to the future development.** Japan Atomic Industrial Forum, Inc., Tokyo (Japan); Japan Radioisotope Association, Tokyo (Japan); Atomic Energy Society of Japan, Tokyo (Japan). 1994. 596p. (In Japanese, English). (CONF-940268–: 21. Japan conference on radiation and radioisotopes, Tokyo (Japan), 2-4 Feb 1994). Order Number DE94785275. Source: OSTI; NTIS; INIS.

This publication is the collection of the papers presented at the title conference. The 54 of the presented papers are indexed individually. (J.P.N.).

28892 (JAERI-M–94-017) **Annual report of the Osaka Laboratory for Radiation Chemistry Japan Atomic Energy Research Institute, (No. 26): April 1, 1992 - March 31, 1993.** Japan Atomic Energy Research Inst., Tokyo (Japan). Mar 1994. 64p. Order Number DE94785277. Source: OSTI; NTIS; INIS.

The annual research activities of Osaka Laboratory for Radiation Chemistry, JAERI during the fiscal year of 1992 (April 1, 1992 - March 31, 1993) are described. The research activities were conducted under the two research programs: the study on laser-induced organic chemical reactions and the study on basic radiation technology for functional materials. Detailed descriptions of the activities are presented in the following subjects: laser-induced organic synthesis, modification of polymer surface by laser irradiation, radiation-induced polymerization, preparation of fine particles by gamma ray irradiation, and electron beam dosimetry. The operation report of the irradiation facilities is also included. (author).

28893 (KFK–5325) **List of scientific publications of the Karlsruhe Nuclear Research Center in 1993.** Kernforschungszentrum Karlsruhe GmbH (Germany). Mar 1994. 167p. (In German). Order Number DE94785972. Source: OSTI; NTIS (US Sales Only); INIS.

The report contains the titles of all publications from 1993. In the case of patents, all rights established or published during 1993 are indicated: patents, information sheets (DE-OS). The list of publications is ordered according to institutes. Under projects, only published project reports and publications by staff working on the particular projects are listed. Also included are publications printed in the Kernforschungszentrum from research and development plans within the production Technology Project (PFT) and the project called 'European Research Center for the Control of Air Pollution' (PEF), which were carried out by the Kernforschungszentrum as project sponsor in cooperation with firms and institutes. The list also includes publications of the branch of the Federal Research Institute for Nutrition based at the Kernforschungszentrum. (orig.)

28894 (UCRL-ID–115057) **Underground storage tank 291-D1U1: Closure plan.** Mancieri, S.; Giuntoli, N. Lawrence Livermore National Lab., CA (United States). Sep 1993. 85p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. Order Number DE94015355. Source: OSTI; NTIS; GPO Dep.

The 291-D1U1 tank system was installed in 1983 on the north side of Building 291. It supplies diesel fuel to the Building 291 emergency generator and air compressor. The emergency generator and air compressor are located southwest and southeast, respectively, of the tank (see Appendix B, Figure 2). The tank system consists of a single-walled, 2,000- gallon, fiberglass tank and a fuel pump system, fill pipe, vent pipe, electrical conduit, and fuel supply and return piping. The area to be excavated is paved with asphalt and concrete. It is not known whether a concrete anchor pad is associated with this tank. Additionally, this closure plan assumes that the diesel tank is below the fill pad. The emergency generator and air compressor for Building 291 and its associated UST, 291-D1U1, are currently in use. The generator and air compressor will be supplied by a temporary above-ground fuel tank prior to the removal of 291-D1U1. An above-ground fuel tank will be installed as a permanent replacement for 291-D1U1. The system was registered with the State Water Resources Control Board on June 27, 1984, as 291-41D and has subsequently been renamed 291-D1U1. Figure 1 (see Appendix B) shows the location of the 291-D1U1 tank system in relation to the Lawrence Livermore National Laboratory (LLNL). Figure 2 (see Appendix B) shows the 291-D1U1 tank system in relation to Building 291. Figure 3 (see Appendix B) shows a plan view of the 291-D1U1 tank system.

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Refer also to citation(s) 27200, 27275, 27360, 27368, 27371, 27372, 27400, 27509, 27539, 27541, 27543, 27552, 27557, 27562, 27652, 27663, 27664, 27669, 27670, 27671, 27741, 27771, 27773,

27778, 27790, 27814, 27838, 27839, 27840, 27841, 27845, 27854, 27858, 27864, 27887, 27901, 27955, 27957, 27998, 28005, 28008, 28009, 28032, 28037, 28038, 28045, 28046, 28134, 28139, 28162, 28163, 28237, 28304, 28314, 28366, 28389, 28401, 28403, 28404, 28406, 28407, 28409, 28411, 28412, 28418, 28423, 28425, 28426, 28427, 28429, 28431, 28432, 28446, 28447, 28453, 28455, 28456, 28458, 28471, 28494, 28499, 28526, 28531, 28571, 28733, 28754, 28787, 28880

28895 (AECL–10777, pp. 2-3) **Welcoming address.** Kossilov, A. (International Atomic Energy Agency, Vienna (Austria)). Atomic Energy of Canada Ltd., Chalk River, ON (Canada). Chalk River Nuclear Labs. Feb 1993. (CONF-9209425–: International Working Group on Nuclear Power Plant Control and Instrumentation, Chalk River (Canada), 8-11 Sep 1992). In *Proceedings.* 330p. Order Number DE94632739. Source: OSTI; NTIS (US Sales Only); INIS.

Computer systems are being used increasingly to support operation and maintenance personnel in nuclear power plants. Computers are having a significant impact, both good and bad, on plant safety. Accepted validation and verification methods would enhance the acceptance of computers by users, vendors, and regulators. The discussions at this conference will be useful in summarizing the current situation and providing recommendations to the International Atomic Energy Agency. (L.L.).

28896 (AECL–10777, pp. 4-9) **Quality in nuclear design.** Meneley, D.A. (Atomic Energy of Canada Ltd., Pinawa, MB (Canada). Whiteshell Nuclear Research Establishment). Atomic Energy of Canada Ltd., Chalk River, ON (Canada). Chalk River Nuclear Labs. Feb 1993. (CONF-9209425–: International Working Group on Nuclear Power Plant Control and Instrumentation, Chalk River (Canada), 8-11 Sep 1992). In *Proceedings.* 330p. Order Number DE94632739. Source: OSTI; NTIS (US Sales Only); INIS.

Software in nuclear stations can and does make important contributions to safety. The software comparators (programmable digital comparators) in CANDU 600 MW units are more reliable than the older relay units, with both higher reliability to act on demand and lower spurious activation rates. More intelligent interpretation of plant conditions is expected, in the future, to provide even greater safety and lower spurious trip rates in special safety systems. Much of the routine, repetitive work of the control room operator can be taken over by control computers, as has been demonstrated successfully during hundreds of thousands of nuclear plant operating hours. The operator's mind therefore can be freed to test, inspect, and maintain plant systems - operations which are difficult if not impossible to do properly with machines.

28897 (AECL–10777, pp. 30-54) **Comparison of international standards for digital safety system verification and validation.** Bhatt, S.C. (Electric Power Research Inst., Palo Alto, CA (United States)); Chanal, L. Atomic Energy of Canada Ltd., Chalk River, ON (Canada). Chalk River Nuclear Labs. Feb 1993. (CONF-9209425–: International Working Group on Nuclear Power Plant Control and Instrumentation, Chalk River (Canada), 8-11 Sep 1992). In *Proceedings.* 330p. Order Number DE94632739. Source: OSTI; NTIS (US Sales Only); INIS.

A study was performed to evaluate different international standards for software verification and validation of digital safety systems suitable for nuclear power plant applications. Since the verification and validation of the digital safety system should be considered from the entire digital system life-cycle point of view, the standards for each phase of the life cycle of the safety system were compared. The major phases of the digital system life cycle considered are system requirements, system test-bed requirements, design and construction, system hardware and software specifications, designs, test, integration, plant implementation, and maintenance phases. Some of the conclusions are: (1) there are too many standards; (2) none of the existing standards provide complete guidance to the developer, regulator, and managers for consistently and practically applying the standards at each phase of the life-cycle; (3) there is no uniformity among the international standards concerning the level of depth and details to be followed by the users; (4) inconsistencies among the standards and their interpretations have led to practical difficulties among developers and regulators; (5) practical guidance on how to handle verification and validation issues such as how to identify and test unintended functions, how to handle common cause failures, what are the qualitative and quantitative reliability measures to use, how much testing is good enough is either missing or not addressed. The authors recommend that a uniform international standard and a practical framework for the digital safety system verification and validation should be developed and the efforts in this direction should start now. (Author) 37 refs., 5 tabs., 2 figs.

28898 (AECL–10777, pp. 55-66) **ISO/IEC standardization in software engineering with respect to safety related systems: An Ontario Hydro perspective on issues and directions.** Joannou, P.K. (Ontario Hydro, Toronto, ON (Canada)); Harauz, J. Atomic Energy of Canada Ltd., Chalk River, ON (Canada). Chalk River Nuclear Labs. Feb 1993. (CONF-9209425–: International Working Group on Nuclear Power Plant Control and Instrumentation, Chalk River (Canada), 8-11 Sep 1992). In *Proceedings.* 330p. Order Number DE94632739. Source: OSTI; NTIS (US Sales Only); INIS.

The importance of the standardization effort for computer systems containing software important to safety is increasingly reflected by the many national and international efforts currently in progress. IEC TC65 and IEC TC45, notably, have working groups dealing with generic and nuclear safety related and safety critical computer systems. There are notable military standards efforts in this area. The U.K. Ministry of Defence has issued Interim Defense Standard MOD 00-55 for 'The Procurement of Safety Critical Software in Defense Equipment' The U.S. Department of Defence has initiated an effort to extend DOD-STD-2167-A to address formal methods for safety and security systems with critical requirements. The Canadian Standards Association is developing a national standard for nuclear safety critical computer systems based mainly on the results of an extensive program undertaken to address licensing issues associated with the safety shutdown computer-based systems for the Darlington Nuclear Generating Station. SC7 within JTC1, the joint ISO and IEC standards committee, is producing standards to handle generic software engineering issues, and is attempting to rationalize the many available standards into a coherent set. This paper identifies the current issues that are facing the nuclear power industry (but are generically applicable to other industries) in the area of software engineering of safety related software, reviews the current related IEC, ISO and other standards work activities to assess the trends on how these issues are being addressed, and identifies areas for further work that need to be undertaken to address the issues. (Author) 5 refs., 3 tabs.

28899 (AECL–10777, pp. 68-79) **A brief examination of the difficulties of using software for nuclear safety applications.** Baldwin, J.A. (AEA Technology, Winfrith (United Kingdom)); Wall, D.N. Atomic Energy of Canada Ltd., Chalk River, ON (Canada). Chalk River Nuclear Labs. Feb 1993. (CONF-9209425–: International Working Group on Nuclear Power Plant Control and Instrumentation, Chalk River (Canada), 8-11 Sep 1992). In *Proceedings.* 330p. Order Number DE94632739. Source: OSTI; NTIS (US Sales Only); INIS.

Some of the difficulties encountered in the introduction of safety critical computer based systems for nuclear plant are identified. System and software research and development activities to combat these difficulties are described and the details of one major international collaborative exercise, DARTS, are given. One application of the technology used to produce a computer-based shutdown system for the Dungeness B AGR is outlined. (Author) 10 refs., 2 figs.

28900 (AECL–10777, pp. 80-92) **Cost effective use of software in AGR safety applications.** Morrison, J. (Scottish Nuclear Ltd., Glasgow (United Kingdom)); Pymm, P. Atomic Energy of Canada Ltd., Chalk River, ON (Canada). Chalk River Nuclear Labs. Feb 1993. (CONF-9209425–: International Working Group on Nuclear Power Plant Control and Instrumentation, Chalk River (Canada), 8-11 Sep 1992). In *Proceedings.* 330p. Order Number DE94632739. Source: OSTI; NTIS (US Sales Only); INIS.

Economic pressures on Scottish Nuclear have been significant since its retention in state ownership following the UK's Electrical Supply Industry (ESI) privatisation two years ago, and will continue

to increase as other utilities' generation costs become more competitive. Software systems play a significant role in both the maintenance of safety claims and in the output of Scottish Nuclear's Advanced Gas-cooled Reactor (AGR) generating plant. This paper takes as its theme Scottish Nuclear's positive and negative experiences with high reliability software. A cost effective software life cycle for the maintenance of safety related software with unreliability demands in the range 1.0E-1 to 1.0E-2 pfd for reactor control and fuel handling applications based on a customer-software integrator-software supplier model is described. Experience from the evolution of this life cycle has led to the concept of an integrated software maintenance environment. The problems leading to Scottish Nuclear's move away from the use of software for safety critical (1.0E-4 pfd) applications and its substitution by non-processor technology on the fuel route are outlined. Finally the paper describes Scottish Nuclear's medium term policy for the engineering of safety critical applications. (Author) 2 refs., 3 figs.

28901 (AECL–10777, pp. 95-105) **Software life after in-service.** Tseng, M. (Previse Inc., Willowdale, ON (Canada)); Eng, P. Atomic Energy of Canada Ltd., Chalk River, ON (Canada). Chalk River Nuclear Labs. Feb 1993. (CONF-9209425–: International Working Group on Nuclear Power Plant Control and Instrumentation, Chalk River (Canada), 8-11 Sep 1992). In *Proceedings*. 330p. Order Number DE94632739. Source: OSTI; NTIS (US Sales Only); INIS.

Software engineers and designers tend to conclude a software project at the in-service milestone of the software life cycle. But the reality is that the 'life after in-service' is significantly longer than other phases of the life cycle, typically 20 years or more depending on the maintainability of the hardware platform and the designed life of the plant. During this period, the software asset (as with other physical assets in the plant) continues to be upgraded to correct deficiencies, meet new requirements, cope with obsolescence of equipment and so on. The software life cycle ends with a migration of the software to a different platform. It is typical in a software development project to put a great deal of emphasis on design methodologies, techniques, tools, development environment, standard procedures, and project management to ensure quality product is delivered on schedule and within budget. More often than not, a disproportion of emphasis is placed on the issues and needs of the in-service phase. Once the software is in-service, the designers move on to other projects, while the maintenance and support staff must manage the software. This paper examines the issues in three steps. First it presents a view of software from maintenance and support staff perspectives, including complexity of software, suitability of documentation, configuration management, training, difficulties and risks associated with making changes, required skills and knowledge. Second, it identifies the concerns raised from these viewpoints, including costs of maintaining the software, ability to meet additional requirements, availability of support tools, length of time required to engineer and install changes, and a strategy for the migration of software asset. Finally it discusses some approaches to deal with the concerns. (Author) 5 refs., fig.

28902 (AECL–10777, pp. 106-110) **Project management of computer-based safety critical systems.** Andrewartha, N. (Rolls-Royce Ltd., Derby (United Kingdom)). Atomic Energy of Canada Ltd., Chalk River, ON (Canada). Chalk River Nuclear Labs. Feb 1993. (CONF-9209425–: International Working Group on Nuclear Power Plant Control and Instrumentation, Chalk River (Canada), 8-11 Sep 1992). In *Proceedings*. 330p. Order Number DE94632739. Source: OSTI; NTIS (US Sales Only); INIS.

The management of a computer-based system is difficult, even armed with the best tools and methods available. The traditional project management metrics of cost, timescales and quality are often difficult to predict, particularly regarding software. Traditionally, Rolls Royce Associates (RRA) has reasoned that the reliability of the software must not degrade the overall system reliability below that attributed to the hardware. The inherent quantification required to safety justify a software-based system calls for a more rigorous approach to the management of projects. This paper discusses RRA's experiences in developing such an approach. (Author).

28903 (AECL–10777, pp. 112-118) **OOP techniques for control systems software design.** Rovere, L.A. (Comision Nacional de Energia Atomica, San Carlos de Bariloche (Argentina). Centro Atomico Bariloche). Atomic Energy of Canada Ltd., Chalk River, ON (Canada). Chalk River Nuclear Labs. Feb 1993. (CONF-9209425–: International Working Group on Nuclear Power Plant Control and Instrumentation, Chalk River (Canada), 8-11 Sep 1992). In *Proceedings*. 330p. Order Number DE94632739. Source: OSTI; NTIS (US Sales Only); INIS.

The process of software design for nuclear power plants has several stages that must be fulfilled for a successful application. The first deals with the suitability of the concepts being applied to control the process itself, i.e. the control theory approach used, rationale for imposed limits, etc., that could be termed the formal specification generation. The second encompasses the processes of insuring the correctness of the software according to its formal specification. There are several approaches to dealing with these issues being developed worldwide, from the purely analytical to exhaustive testing methods. The purpose of our research effort is to explore and develop new tools for designing and testing control algorithms based in object-oriented programming (OOP) techniques and iconic interfaces. These two technologies will empower the designer by providing powerful yet simple means to introduce faults, investigate their effects and introduce configuration changes. Software development approaches that both encourage and force modularity with explicit interfacing definition could be of great help towards automatic software verification techniques. It is in this context that OOP techniques could play an important role, since they could be thought of as independent units interacting through allowed communication channels. Object classes implementing most common algorithms have been developed and used in our research laboratory computing environment with good results. It is feasible, in principle at least, to design a topology advisor/verifier that parses the control algorithm to detect anomalous configurations. Future research topics include the development of a prototype topology parser to explore its potential applicability in software design. (Author) 6 refs., 2 figs.

28904 (AECL–10777, pp. 119-131) **An integrated toolset for migration of assembly language software: New tools for old systems.** Gould, D.J. (Previse Inc., Willowdale, ON (Canada)); Eng, P. Atomic Energy of Canada Ltd., Chalk River, ON (Canada). Chalk River Nuclear Labs. Feb 1993. (CONF-9209425–: International Working Group on Nuclear Power Plant Control and Instrumentation, Chalk River (Canada), 8-11 Sep 1992). In *Proceedings*. 330p. Order Number DE94632739. Source: OSTI; NTIS (US Sales Only); INIS.

Software maintenance for pre-1980 assembly language systems is costly, in large part due to the lack to tooling which today would be considered standard. For many such systems employed in mission critical applications, such as reactor control, the demand for quality further increases the cost intensity of software maintenance. To address this need Previse Inc. proposes an integrated workstation platform combining several tools, within which software maintenance would be made for the remaining software life. The core of this platform would comprise a DBMS environment, within which the target code would become data in a database. In this environment code changes would be treated as transactions to a database, with maintenance of database consistency a core mission of the toolset. Code changes would be verified using a combination of semi-automated database consistency checks and testing using a variety of built-in dynamic analysis tools. This federally supported Previse R and D programme is currently in midstream. Though not without implementation problems, confidence remains high that the overall objective, that is to decrease the cost of this software maintenance by 50%, can be met. (Author) 21 refs.

28905 (AECL–10777, pp. 132-149) **Dynamic analysis of distributed real-time systems.** Schildt, G.H. (Technische Univ., Vienna (Austria)). Atomic Energy of Canada Ltd., Chalk River, ON (Canada). Chalk River Nuclear Labs. Feb 1993. (CONF-9209425–: International Working Group on Nuclear Power Plant Control and Instrumentation, Chalk River (Canada), 8-11 Sep 1992). In *Proceedings*. 330p. Order Number DE94632739. Source: OSTI; NTIS (US Sales Only); INIS.

Real-time systems are characterized by reliability and predictability. According to event-driven systems one has to prove that

specifications are met. Up to now tests of vital process software have been done as static C1-coverage tests. Applying this approach one can only show that there is no dead code within the source code. Errors or inconsistencies within the specification cannot be detected this way. Based on run-time instrumentation a new approach for dynamic analysis corresponding to run-time behaviour is presented. This method is based on events and intervals monitored by a versatile timing analyzer. To specify events and intervals an event definition language is introduced. (Author) 6 refs., 4 figs.

28906 (AECL–10777, pp. 165-176) **Software licensing and assessment: Problems and solutions.** Barnes, M. (AEA Safety and Reliability, Culcheth (United Kingdom)); Bradley, P.A. Atomic Energy of Canada Ltd., Chalk River, ON (Canada). Chalk River Nuclear Labs. Feb 1993. (CONF-9209425–: International Working Group on Nuclear Power Plant Control and Instrumentation, Chalk River (Canada), 8-11 Sep 1992). In *Proceedings.* 330p. Order Number DE94632739. Source: OSTI; NTIS (US Sales Only); INIS.

This paper discusses licensing and assessment issues for computer software used in safety critical plant. It is based upon a European collaborative research project called DARTS (Demonstration of Advanced Reliability Techniques for Systems). Its partners are from France, Germany, Spain, and the UK, and it is managed by AEA Technology, UK. DARTS is a 4-year project, which began in the summer of 1989. DARTS was conceived, amongst other things, because of the general lack of widely-accepted standards and guidelines for the development and licensing of safety critical systems employing software. This paper focuses solely on some of the current licensing issues faced by developers and assessors/ licensors, and describes how the DARTS project is attempting to resolve some of those issues: what criteria should be considered for licensing software? what are the cost/benefits of the various licensing approaches? how does the licensor weigh the submitted justification? DARTS consists of four diverse hardware and software multi-input channels feeding into a majority voting system; this represents a protection system for a notional nuclear reactor. The individual channels are implemented, followed by a third party independent assessment, and then subjected to licensing, the broad objective of which is to determine if the channels are qualified to form part of a high integrity nuclear reactor protection system. Following the channel licensing procedure, the channels will then be connected to the majority voting system, and subjected to system assessment followed by system licensing. The focus of this paper is licensing issues related to the DARTS project. The paper also discusses wider licensing and assessment issues, including emerging standards and guidelines, and future directions for software licensing and assessment. The implications both to senior management and technical staff of these future directions are mentioned. (Author) 14 refs., 2 figs., tab.

28907 (AECL–10777, pp. 177-188) **Quality assurance and quality control program for digital safety protection systems in nuclear power plants.** Shirakawa, T. (Tokyo Electric Power Co., Inc. (Japan)); Tochigi, T.; Iwaki, K.; Yokomura, T. Atomic Energy of Canada Ltd., Chalk River, ON (Canada). Chalk River Nuclear Labs. Feb 1993. (CONF-9209425–: International Working Group on Nuclear Power Plant Control and Instrumentation, Chalk River (Canada), 8-11 Sep 1992). In *Proceedings.* 330p. Order Number DE94632739. Source: OSTI; NTIS (US Sales Only); INIS.

The quality assurance and quality control (QA/QC) program for the digital safety protection system in Japan has been reviewed to set up a practical implementation method of the activities, clarifying the design and manufacturing process. A risk analysis was made comparing analog systems with digital systems to find that hardware failures occur at random and can be effectively eliminated by proper use of redundancy, programming errors may cause common mode failures and must be eliminated, and proofs of the elimination must be verified by the QA/QC activities. Software of the digital safety protection system for Kashiwazaki-Kariwa unit 6 and 7 (K-6/ 7) can be easily verified by the use of a cyclic execution program and a symbolic language called POL (Problem Oriented Language). It is concluded that the integrity of software needed for the safety protection system can be verified and validated by clarifying design and manufacturing process, verifying conformance at each phase of the process, having third parties individually review the program, and documenting the review as defined in JEAG 4609. The implementation of the QA/QC plan was reviewed to find that V and V (verification and validation) aims at ensuring clarity and traceability, which is also the purpose of conventional QA/QC. In other words, V and V is defined to express detailed procedures explicitly within the framework of the conventional QA/QC. The implementation of V and V was set up according to this review, and a regulatory review will be made in a short time. (Author) 3 tabs., 3 figs.

28908 (AECL–10777, pp. 190-204) **Finnish experiences on licensing and using of programmable digital systems in nuclear power plants.** Haapanen, P. (Valtion Teknillinen Tutkimuskeskus, Espoo (Finland)); Maskuniitty, M.; Heimburger, H.; Hall, L.E.; Manninen, T. Atomic Energy of Canada Ltd., Chalk River, ON (Canada). Chalk River Nuclear Labs. Feb 1993. (CONF-9209425–: International Working Group on Nuclear Power Plant Control and Instrumentation, Chalk River (Canada), 8-11 Sep 1992). In *Proceedings.* 330p. Order Number DE94632739. Source: OSTI; NTIS (US Sales Only); INIS.

Finnish utility companies, Imatran Voima Oy (IVO) and Teollisuuden Voima (TVO), and the licensing authority, the Finnish Centre for Radiation and Nuclear Safety (STUK), are preparing for a new nuclear power plant in Finland. Plant vendors are proposing programmable digital automation systems for both the safety-related and the operational I and C (instrumentation and control) systems in this new unit. Also in existing plant units the replacement of certain old analog systems with state-of-the-art digital ones will become necessary in the years to come. Licensing of programmable systems for safety critical applications requires a new approach due to the special properties and failure modes of these systems. The major difficulties seem to be in the assessment and quantification of software reliability. The Technical Research Centre of Finland has in co-operation with the authority and the utilities conducted a project (AJA) to develop domestically applicable licensing requirements, guidelines and practices. International standards, guidelines and licensing practices have been analyzed in order to specify national licensing requirements. The paper describes and discusses the findings and experiences of the AJA project so far. The experience in introducing advanced programmable digital control and computer systems in the operating nuclear power plants will be covered briefly. Although these systems are not safety-related but systems of more general interest regarding nuclear safety, some routines regarding the licensing of safety- related systems have been followed. In these backfitting and replacement projects some experience have been gained in how to license safety-related programmable systems. (Author) 31 refs., 2 figs.

28909 (AECL–10777, pp. 205-216) **The UK regulator's approach to the acceptance of software-based safety systems.** Hunns, D.M. (Health and Safety Executive, Bootle (United Kingdom). Nuclear Installations Inspectorate); Wainwright, N.; Ball, A. Atomic Energy of Canada Ltd., Chalk River, ON (Canada). Chalk River Nuclear Labs. Feb 1993. (CONF-9209425–: International Working Group on Nuclear Power Plant Control and Instrumentation, Chalk River (Canada), 8-11 Sep 1992). In *Proceedings.* 330p. Order Number DE94632739. Source: OSTI; NTIS (US Sales Only); INIS.

UK law determines that the responsibility for the safety of a nuclear installation rests with licensees. They are also responsible for producing supporting, documented safety cases. This is to satisfy themselves that the proposed plant will be adequately safe, but it is also the vehicle by which they must similarly convince the Nuclear Installations Inspectorate, NII (a Division within the UK's Health and Safety Executive), whose permission by law they must obtain before the plant can be operated. The NII assessment of the licensee's safety case will be undertaken against its own Safety Assessment Principles. These comprise a published set of objectives whose primary purpose is to secure radiological safety. They are currently undergoing substantial revision, but until the new version has been adopted the old principles remain in place. When the principles were developed the impact of computer-based technology on nuclear plants had not extended into the crucial areas of safety systems and the particular problems of their safety demonstration had not been encountered. It had been recognised, however, that certain safety issues (e.g. pressure vessel integrity)

are not readily resolvable by the traditional approaches, and so a principle, the so-called "pecial case procedure· was included. This offered the option for the development of a safety demonstration formula matched to the particular problem and geared to providing acceptable confidence in the safety claimed. This principle has been invoked to address the particular problems associated with the safety demonstration of software-based systems in high integrity applications. (Author).

28910 (AECL–10777, pp. 242-247) **Formal and conventional methods: Complementary techniques for error elimination.** Hamilton, V. (Rolls-Royce Ltd., Derby (United Kingdom)). Atomic Energy of Canada Ltd., Chalk River, ON (Canada). Chalk River Nuclear Labs. Feb 1993. (CONF-9209425–: International Working Group on Nuclear Power Plant Control and Instrumentation, Chalk River (Canada), 8-11 Sep 1992). In *Proceedings.* 330p. Order Number DE94632739. Source: OSTI; NTIS (US Sales Only); INIS.

This paper discusses the benefits of combining both mathematically based formal methods and informal conventional structured methods in the development of safety-critical software. The strengths and disadvantages of the two approaches for specification and verification and validation are discussed. The methods discussed in the paper have been developed from practical experience of specifying, designing, building and validating safety-critical systems. (Author) 6 refs.

28911 (AECL–10777, pp. 269-279) **The integrated approach system design methodology.** Vankay, J.B. (Atomic Energy of Canada Ltd., Sheridan Park, ON (Canada). CANDU Operations). Atomic Energy of Canada Ltd., Chalk River, ON (Canada). Chalk River Nuclear Labs. Feb 1993. (CONF-9209425–: International Working Group on Nuclear Power Plant Control and Instrumentation, Chalk River (Canada), 8-11 Sep 1992). In *Proceedings.* 330p. Order Number DE94632739. Source: OSTI; NTIS (US Sales Only); INIS.

The integrated approach is a formal methodology for the design of critical systems. It proceeds from a system description through hardware design specification and software requirement specification to software design and automatic generation of executable code. A characteristic of the process is the use of a graphical function notation to specify the functional software requirements. This permits review of the software requirements by people of many disciplines more readily than with other formal notations. Further, in performing the software design, the structure of the software requirements is maintained. Only local logic additions and small transformations are performed. Finally, since the notation of the software design is formal, executable code is generated directly from it without the need for a manual coding step. In addition, rigorous static verification techniques are used between the software requirements and the software design and the executable code. This ensures, in addition to testing, that all the requirements on the software are met by the executable code. The use of the methodology will result in a high quality cost-effective product. (Author) 5 figs.

28912 (AECL–10777, pp. 280-287) **Software engineering activities at the OECD Nuclear Energy Agency.** Nagel, P. (OECD Nuclear Energy Agency, Issy-les Moulineaux (France)). Atomic Energy of Canada Ltd., Chalk River, ON (Canada). Chalk River Nuclear Labs. Feb 1993. (CONF-9209425–: International Working Group on Nuclear Power Plant Control and Instrumentation, Chalk River (Canada), 8-11 Sep 1992). In *Proceedings.* 330p. Order Number DE94632739. Source: OSTI; NTIS (US Sales Only); INIS.

The activities of the Nuclear Energy Agency in support of software engineering programmes are described. Long standing activities include the computer program services of the NEA Data Bank which collects, tests and distributes software mainly for nuclear power applications, and the software validation activities under the auspices of various NEA standing committees. A new series of activities related to advanced computers (vector and parallel processors) and to quality assurance issues are being initiated by the NEA Nuclear Science Committee. (Author) 4 refs., fig.

28913 (AECL–10777, pp. 288-293) **IAEA activities on software important to safety in nuclear power plants.** Pachner, J. (International Atomic Energy Agency, Vienna (Austria)). Atomic Energy of Canada Ltd., Chalk River, ON (Canada). Chalk River Nuclear Labs. Feb 1993. (CONF-9209425–: International Working Group on Nuclear Power Plant Control and Instrumentation, Chalk River (Canada), 8-11 Sep 1992). In *Proceedings.* 330p. Order Number DE94632739. Source: OSTI; NTIS (US Sales Only); INIS.

Computer software is of increasing importance to safety in nuclear power plants as more software controlled systems important to safety are being installed in new plants, and the modernization of instrumentation and control equipment and systems in existing plants by means of digital data processing is progressing in many countries. The IAEA last year initiated activities to assist member states in ensuring that software based systems important to safety are themselves safe and are properly licensed. This paper provides an overview of these activities, their results and future plans. A state of the art report dealing with key issues of software engineering related to applications important to safety is now being finalized. It will serve as a basis for the development of an IAEA Safety Guide on software. In future, both regulatory and technical aspects of software important to safety will be addressed by the Agency. (Author).

28914 (AECL–10777, pp. 295-305) **Principles of arranging a specialized operating system for the NPP APCS.** Vasilenko, V. (Science and Research Institute of Technology (Russian Federation)); Khairutdinov, A.; Chernykh, V. Atomic Energy of Canada Ltd., Chalk River, ON (Canada). Chalk River Nuclear Labs. Feb 1993. (CONF-9209425–: International Working Group on Nuclear Power Plant Control and Instrumentation, Chalk River (Canada), 8-11 Sep 1992). In *Proceedings.* 330p. Order Number DE94632739. Source: OSTI; NTIS (US Sales Only); INIS.

This paper discusses problems related to the development of software for the low level computers of nuclear power plant (NPP) automated process control systems (APCS). These systems monitor and control process equipment and are connected to the NPP control panel. The authors propose concepts and principles for developing specialized system software. The NPP APCS has a two to three level structure. For the upper level it is appropriate to use more generalized software (operating systems, network support, databases, etc.), but for lower levels it is necessary to develop specialized software to meet often conflicting requirements of hardware configuration and functions. Details of developing an operating system for a OVER-500 power unit are presented. (L.L.).

28915 (AECL–10777, pp. 306-316) **Approaches for quality assurance of the software of NPP control, monitoring and protection systems.** Zayko, I.Y. (Research and Development Institute of Power Engineering, Moscow (Russian Federation)); Mikhailov, M.N.; Sazonov, N.A. Atomic Energy of Canada Ltd., Chalk River, ON (Canada). Chalk River Nuclear Labs. Feb 1993. (CONF-9209425–: International Working Group on Nuclear Power Plant Control and Instrumentation, Chalk River (Canada), 8-11 Sep 1992). In *Proceedings.* 330p. Order Number DE94632739. Source: OSTI; NTIS (US Sales Only); INIS.

An integrated control system (ICS) for a nuclear power plant (NPP) including a microprocessor-based protection system is being developed now at the Research and Development Institute of Power Engineering (RDIPE). Validation and verification of ICS safety-related software is to be performed in accordance with IAEA and IEC standards and guidelines. GPAN (the Russian nuclear regulatory body) requires the numerical reliability assessment of software designed for safety related control, monitoring and protection systems of NPP. This is under way now at RDIPE in the framework of software quality assurance activities. Methods for numerical assessment of software reliability at the stage of design and source code development were proposed for both software modules and large software systems. At the present time these methods have been implemented on a PC. They will be used for reliability justification of software being developed. It is planned to implement a number of alternative methods of reliability calculation. Proposed methods are based on the Djelinski-Moranda model. It is planned to implement several alternative methods of software reliability assessment at the stage of testing together with the adaptive mechanism of their initialization. The computer system for software

reliability assessment is being developed now to predict and evaluate parameters of software complexity, reliability and quality at all stages of the software life cycle. (Author) 13 refs., tab.

28916 (ANL/DIS/CP–82284) **A high performance graphics algorithm.** North, M.J. (Argonne National Lab., IL (United States)); Zhao, S. Argonne National Lab., IL (United States). [1994]. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-9408120–1: 2. Pacific conference on computer graphics and applications and 4th international conference on CAD, CAM technology, Beijing (China), 26-29 Aug 1994). Order Number DE94015033. Source: OSTI; NTIS; GPO Dep.

Rendering images of complex collections of general objects in multidimensional space is typically very time consuming. The process of displaying such images is often a linear function of the number objects being considered. This behavior can become unacceptable when the number of objects to be considered is large. This paper describes an algorithm to address this problem. The graphics algorithm presented here is composed of a storage algorithm and a selection algorithm. Both of these components are described in relation to a specialized tree data structure. The storage algorithm is proven to exhibit O(n log n) average time behavior and the selection algorithm is proven to exhibit O(log n) average time behavior. This paper focuses on two dimensional images but natural extensions of the basic algorithms to higher dimensional spaces are also considered.

28917 (ANL/EA/CP–82126) **Estimation of the effective distribution coefficient from the solubility constant.** Wang, Yug-Yea; Yu, C. Argonne National Lab., IL (United States). [1994]. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-940815–60: International nuclear and hazardous waste management conference, Atlanta, GA (United States), 14-18 Aug 1994). Order Number DE94015037. Source: OSTI; NTIS; INIS; GPO Dep.

An updated version of RESRAD has been developed by Argonne National Laboratory for the US Department of Energy to derive site-specific soil guidelines for residual radioactive material. In this updated version, many new features have been added to the, RESRAD code. One of the options is that a user can input a solubility constant to limit the leaching of contaminants. The leaching model used in the code requires the input of an empirical distribution coefficient, K_d, which represents the ratio of the solute concentration in soil to that in solution under equilibrium conditions. This paper describes the methodology developed to estimate an effective distribution coefficient, Kd, from the user-input solubility constant and the use of the effective K_d for predicting the leaching of contaminants.

28918 (ANL/ECT/CP–82953) **Six virtual inches to the left: The problem with IPng.** Carlson, R. (Argonne National Lab., IL (United States)); Ficarella, D. Argonne National Lab., IL (United States). May 1994. 39p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-9408119–1: 1994 USENIX conference, Oakland, CA (United States), 1-2 Aug 1994). Order Number DE94015034. Source: OSTI; NTIS; GPO Dep.

This memo describes an Internet information track protocol for the Internet community. It proposes that a locator address (TA) be assigned to Transmission Control Protocol (TCP). The purpose of this TA is to uniquely identify an Internet node without specifing any routing information. This new version of TCP would contain support for high bandwidth-delay networks. Support for multiple network layer (Internet Protocol) protocols is also possible with this new TCP. Distribution of this document is unlimited. This RFC suggests that a new version of TCP be developed (TCPv11) and deployed. This version of TCP would contain a globally unique transport protocol address (TA). Assiging an address to TCP would allow for the support of multiple network layer protocols (IPng's). The Ta would identify the location of an Internet node. The IPng layer would provide routing information to the Internet. Seperating the location and routing functions will greatly increase the versitily of the Internet.

28919 (ANL/IPNS/PP–79234) **MPRINT: VAX printing made simple.** Worlton, T. Argonne National Lab., IL (United States). [1994]. 28p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. Order Number DE94016338. Source: OSTI; NTIS; GPO Dep.

Users with stand-alone personal computers and personal printers usually find printing simple, but on a VAX computer or VAX cluster there may be many printers of different types located in different areas. The print queues set up for these printers may require different form qualifiers and may not all be able to print all documents. This article describes the basic steps a VAX system manager should take in setting up and managing print queues on a VAX and tells how to access these queues from a VAX, Unix, Macintosh, or DOS Computer. It gives a basic overview, but includes several helpful items that are obscure or completely undocumented. Following this overview, there is a description of a Fortran program, MPRINT, written to simplify printing for users. The MPRINT program simplifies the choice of printers and print forms for users of VAX print queues by allowing them to select from a one line per queue menu. The menu includes queue descriptions and only lists printers which can correctly print the specified file. MPRINT selects the correct form to use based on file type and maximum record length of the file. MPRINT may be useful at your site, and provides examples of a number of system services. MPRINT includes routines to do a user open of a file and get information from the File and Record Access Blocks (FAB and RAB), and a routine to obtain information about print queues. There are also routines to parse a file name, detab a character buffer, and trim trailing nulls and blanks from a character string.

28920 (ANL/MCS/PP–77111) **An informal introduction to program transformation and parallel processors.** Hopkins, K.W. (Southwest Baptist Univ., Bolivar, MO (United States)). Argonne National Lab., IL (United States). [1994]. 17p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. Order Number DE94016343. Source: OSTI; NTIS; GPO Dep.

In the summer of 1992, I had the opportunity to participate in a Faculty Research Program at Argonne National Laboratory. I worked under Dr. Jim Boyle on a project transforming code written in pure functional Lisp to Fortran code to run on distributed-memory parallel processors. To perform this project, I had to learn three things: the transformation system, the basics of distributed-memory parallel machines, and the Lisp programming language. Each of these topics in computer science was unfamiliar to me as a mathematician, but I found that they (especially parallel processing) are greatly impacting many fields of mathematics and science. Since most mathematicians have some exposure to computers, but.certainly are not computer scientists, I felt it was appropriate to write a paper summarizing my introduction to these areas and how they can fit together. This paper is not meant to be a full explanation of the topics, but an informal introduction for the "mathematical layman." I place myself in that category as well as my previous use of computers was as a classroom demonstration tool.

28921 (ANL/MCS/PP–77112) **An informal introduction to parallel processors.** Hopkins, K.W. (Southwest Baptist Univ., Bolivar, MO (United States)). Argonne National Lab., IL (United States); Southwest Baptist Univ., Bolivar, MO (United States). [1994]. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. Order Number DE94016347. Source: OSTI; NTIS; GPO Dep.

In the summer of 1992, I had the opportunity to participate in a Faculty Research Program at Argonne National Laboratory. During that time I came in contact with some developments in computer science that were unfamiliar to me as a mathematician. Since most mathematicians have some exposure to computers, but certainly are not computer scientists, I felt it was appropriate to write a paper summarizing my introduction to parallel processing. This paper is not meant to be a full explanation of the topic, but an informal introduction for the "mathematical layman."

28922 (ANL/MCS/PP–77113) **An informal introduction to program transformation.** Hopkins, K.W. (Southwest Baptist Univ., Bolivar, MO (United States)). Argonne National Lab., IL (United States). [1994]. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. Order Number DE94016342. Source: OSTI; NTIS; GPO Dep.

In the summer of 1992, I had the opportunity to participate in a Faculty Research Program, at Argonne National Laboratory. During that time I came in contact with some developments in computer science that were unfamiliar to me as a mathematician. Since most mathematicians have some exposure to computers, but certainly are not computer scientists, I felt it was appropriate to write a paper summarizing my introduction to program transformation. This paper is not meant to be a full explanation of the topic, but an informal introduction for the "mathematical layman."

28923 (ANL/MCS/PP–77610) **Fast numerical determination of symmetric sparsity patterns.** Carter, R.G. (Univ. of Minnesota, Minneapolis (United States)). Argonne National Lab., IL (United States). [1994]. 28p. Sponsored by USDOE, Washington, DC (United States);Department of Defense, Washington, DC (United States). DOE Contract W-31109-ENG-38. Grant DAAL03-89-C-0038. Order Number DE94016344. Source: OSTI; NTIS; GPO Dep.

The author considers a function g: $\Re^n \rightarrow \Re^n$ for which the Jacobian is symmetric and sparse. Such functions often arise, for instance, in numerical optimization, where g is the gradient of some objective function f so that the Jacobian of g is the Hessian of f. In many such applications one can generate extremely efficient algorithms by taking advantage of the sparsity structure of the problem if this pattern is known a priori. Unfortunately, determining such sparsity structures by hand is often difficult and prone to error. If one suspects a mistake has been made, or if g is a "black box" so that the true structure is completely unknown, one often has no alternative but to compute the entire matrix by finite differences - a prohibitively expensive task for large problems. The author shows that it is possible to numerically determine symmetric sparsity patterns using a relatively small number of g evaluations. Numerical results are shown for n up to 100,000 in which all nonzeros in the Jacobian are correctly identified in about one-hundredth of the time required to estimate the sparsity structure by a full finite difference calculation. When a good initial guess for the sparsity structure is available, numerical results are presented for n up to 500,000, in which all missing nonzeros are correctly located almost five-thousand times faster than would be possible with a full finite difference calculation.

28924 (ANL/MCS/PP–77652) **Asymptotics of a free boundary problem.** Atkinson, F.V.; Kaper, H.G.; Kwong, Man Kam. Argonne National Lab., IL (United States). 5 Oct 1992. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. Order Number DE94016341. Source: OSTI; NTIS; GPO Dep.

This article is concerned with free boundary problems for the differential equations $u'' + (2\nu + 1)/r\, u' + u - u^q = 0$, $r > 0$, where $0 \leq q < 1$ and $\nu \geq 0$. As was shown by Kaper and Kwong, there exists a unique $R > 0$, such that the equation admits a classical solution u that is positive and monotone on (0,R) and that satisfies the boundary conditions $u'(0) = 0$, $u(R) = u'(R) = 0$. This article is concerned with the behavior of R and u(0) as $q \rightarrow 1$.

28925 (ANL/MCS/PP–78200) **Trapezoidal rule quadrature algorithms for MIMD distributed memory computers.** Lyness, J.N. (Argonne National Lab., IL (United States)); Plowman, S.E. Argonne National Lab., IL (United States). [1994]. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. Order Number DE94016369. Source: OSTI; NTIS; GPO Dep.

An approach to multi-dimensional quadrature, designed to exploit parallel architectures, is described. This involves transforming the integral in such a way that an accurate result is given by the trapezoidal rule; and by evaluating the resulting sum in a manner which may be efficiently implemented on parallel architectures. This approach is to be implemented in the Liverpool NAG transputer library.

28926 (ANL/MCS-TM–189) **Nexus: An interoperability layer for parallel and distributed computer systems.** Foster, I.; Kesselman, C.; Olson, R.; Tuecke, S. Argonne National Lab., IL (United States). May 1994. 31p. Sponsored by USDOE, Washington, DC (United States);National Science Foundation, Washington, DC (United States). DOE Contract W-31109-ENG-38. Contract CCR-8809615. Order Number DE94015816. Source: OSTI; NTIS; GPO Dep.

Nexus is a set of services that can be used to implement various task-parallel languages, data-parallel languages, and message-passing libraries. Nexus is designed to permit the efficient portable implementation of individual parallel programming systems and the interoperability of programs developed with different tools. Nexus supports lightweight threading and active message technology, allowing integration of message passing and threads.

28927 (CONF-940894–Absts.) **Abstracts and program proceedings of the 1994 meeting of the International Society for Ecological Modelling North American Chapter.** Kercher, J.R. Lawrence Livermore National Lab., CA (United States). Jun 1994. 40p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. From Annual Ecological Society of America (ESA) meeting: science and public policy; Knoxville, TN (United States); 7-11 Aug 1994. Order Number DE94016456. Source: OSTI; NTIS; GPO Dep.

This document contains information about the 1994 meeting of the International Society for Ecological Modelling North American Chapter. The topics discussed include: extinction risk assessment modelling, ecological risk analysis of uranium mining, impacts of pesticides, demography, habitats, atmospheric deposition, and climate change.

28928 (DOE/ER/25176–1) **Performance measurement and analysis techniques for parallel and distributed programs: Technical progress report, August 1, 1993–July 31, 1994.** Miller, B.P.; Larus, J.R. Wisconsin Univ., Madison, WI (United States). Dept. of Computer Sciences. [1994]. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-93ER25176. Order Number DE94016429. Source: OSTI; NTIS; GPO Dep.

During the first of our grant, we have made substantial progress on our performance tools research. We have concentrated on our techniques for dynamic program instrumentation and on support of high-level parallel languages and environments. In addition, we have performed an interesting, study in a related area, virtual memory scheduling for parallel systems.

28929 (DOE/RL–93-24-9) **Hanford Environmental Information System (HEIS): Volume 9, Field Quality Control subject area.** Schreck, R.I. (Westinghouse Hanford Co., Richland, WA (United States)). USDOE Richland Operations Office, WA (United States). 15 Apr 1994. 34p. Sponsored by USDOE, Washington, DC (United States). Order Number DE94015647. Source: OSTI; NTIS; GPO Dep.

The purpose of the HEIS Field Quality Control subject area is to manage the data acquired from field quality control samples. Field quality control samples are used to determine if sample contamination has occurred at some point in the sampling process. Four major types of data comprise the Field Quality Control subject area. Data about samples, spike samples, chemical and/or radiologic analysis of field quality control samples, and relationships between field quality control and non-quality control samples.

28930 (EGG-EE–11298-Pt.1) **Automatic TLI recognition system: Part 1: System description.** Partin, J.K.; Lassahn, G.D.; Davidson, J.R. EG and G Idaho, Inc., Idaho Falls, ID (United States). May 1994. 59p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE94015253. Source: OSTI; NTIS; GPO Dep.

This report describes an automatic target recognition system for fast screening of large amounts of multi-sensor image data, based on low-cost parallel processors. This system uses image data fusion and gives uncertainty estimates. It is relatively low cost, compact, and transportable. The software is easily enhanced to expand the system's capabilities, and the hardware is easily expandable to increase the system's speed. This volume gives a general description of the ATR system.

28931 (EGG-EE–11298-Pt.2) **Automatic TLI recognition system: Part 2: User's guide.** Partin, J.K.; Lassahn, G.D.; Davidson, J.R. EG and G Idaho, Inc., Idaho Falls, ID (United States). May 1994. 93p. Sponsored by USDOE, Washington, DC (United

States). DOE Contract AC07-76ID01570. Order Number DE94015393. Source: OSTI; NTIS; GPO Dep.

This report describes an automatic target recognition system for fast screening of large amounts of multi-sensor image data, based on low-cost parallel processors. This system uses image data fusion and gives uncertainty estimates. It is relatively low cost, compact, and transportable. The software is easily enhanced to expand the system's capabilities, and the hardware is easily expandable to increase the system's speed. This volume is a user's manual for an Automatic Target Recognition (ATR) system. This guide is intended to provide enough information and instruction to allow individuals to the system for their own applications.

28932 (EGG-RAAM–11182) **Tests of a homogeneous Poisson process against clustering and other alternatives.** Atwood, C.L. EG and G Idaho, Inc., Idaho Falls, ID (United States). May 1994. 28p. Sponsored by Nuclear Regulatory Commission, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE94015382. Source: OSTI; NTIS; INIS; GPO Dep.

This report presents three closely related tests of the hypothesis that data points come from a homogeneous Poisson process. If there is too much observed variation among the log-transformed between-point distances, the hypothesis is rejected. The tests are more powerful than the standard chi-squared test against the alternative hypothesis of event clustering, but not against the alternative hypothesis of a Poisson process with smoothly varying intensity.

28933 (EGG-WM–11344) **INEL Waste and Environmental Information Integration Project approach and concepts.** Dean, L.A.; Fairbourn, P.J.; Randall, V.C.; Riedesel, A.M. EG and G Idaho, Inc., Idaho Falls, ID (United States). Jun 1994. 53p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE94015292. Source: OSTI; NTIS; INIS; GPO Dep.

The Idaho National Engineering, Laboratory (INEL) Waste and Environmental Information integration Project (IWEIIP) was established in December 1993 to address issues related to INEL waste and environmental information including: Data quality; Data redundancy; Data accessibility; Data integration. This effort includes existing information, new development, and acquisition activities. Existing information may not be a database record; it may be an entire document (electronic, scanned, or hard-copy), a video clip, or a file cabinet of information. The IWEIIP will implement an effective integrated information framework to manage INEL waste and environmental information as an asset. This will improve data quality, resolve data redundancy, and increase data accessibility; therefore, providing more effective utilization of the dollars spent on waste and environmental information.

28934 (LA-UR–94-575) **ROOM: A recursive object oriented method for information systems development.** Thelliez, T.; Donahue, S. Los Alamos National Lab., NM (United States). 9 Feb 1994. 16p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-941071–1: 9. ACM SIGPLAN conference on object-oriented programming system, languages and applications, Portland, OR (United States), 27 Oct 1994). Order Number DE94007575. Source: OSTI; NTIS; GPO Dep.

Although complementary for the development of complex systems, top-down structured design and object oriented approach are still opposed and not integrated. As the complexity of the systems are still growing, and the so-called software crisis still not solved, it is urgent to provide a framework mixing the two paradigms. This paper presents an elegant attempt in this direction through our Recursive Object-Oriented Method (ROOM) in which a top-down approach divides the complexity of the system and an object oriented method studies a given level of abstraction. Illustrating this recursive schema with a simple example, we demonstrate that we achieve the goal of creating loosely coupled and reusable components.

28935 (LA-UR–94-895) **An investigation of genetic operators for continuous parameter space.** Grossman, T. (Los Alamos National Lab., NM (United States)); Davidor, Y. Los Alamos National Lab., NM (United States). 9 Mar 1994. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-941058–1: 3. international conference on evolutionary computation: parallel problem solving from nature, Jerusalem (Israel), 9-14 Oct 1994). Order Number DE94009364. Source: OSTI; NTIS; GPO Dep.

The success of a genetic optimization algorithm in continuous parameter space depends on the recombination (crossover) operators that it uses. In this paper we consider a wide spectrum of such operators within a unified framework and study their relative importance in the search process. We consider four basic types recombination operators which cover the relevant exploration potential of a continuous space: Interpolation, Extrapolation, Exchange and Mutation. Each of these basic types may have several variants. We characterize the various operators and their variants by their spatial sampling properties and examine their contributions to the search by applying different mixtures of the operators in several benchmark problems. The results suggest that the optimal mixture of operators may depend on the problem. But, in general, all basic types are needed for efficient optimization.

28936 (LA-UR–94-1250) **Fast stereoscopic images with ray-traced volume rendering.** Adelson, S.J.; Hansen, C.D. Los Alamos National Lab., NM (United States). [1994]. 18p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-941085–3: Visualization '94, Washington, DC (United States), 17-21 Oct 1994). Order Number DE94011703. Source: OSTI; NTIS; GPO Dep.

One of the drawbacks of standard volume rendering techniques is that is it often difficult to comprehend the three-dimensional structure of the volume from a single frame; this is especially true in cases where there is no solid surface. Generally, several frames must be generated and viewed sequentially, using motion parallax to relay depth. Another option is to generate a single spectroscopic pair, resulting in clear and unambiguous depth information in both static and moving images. Methods have been developed which take advantage of the coherence between the two halves of a stereo pair for polygon rendering and ray-tracing, generating the second half of the pair in significantly less time than that required to completely render a single image. This paper reports the results of implementing these techniques with parallel ray-traced volume rendering. In tests with different data types, the time savings is in the range of 70–80%.

28937 (LA-UR–94-1602) **Variable metric conjugate gradient methods.** Barth, T.; Manteuffel, T. Los Alamos National Lab., NM (United States). [1994]. 24p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-9403142–1: International PCG symposium on matrix analysis and parallel computing, Yokohama (Japan), 15-16 Mar 1994). Order Number DE94014796. Source: OSTI; NTIS; GPO Dep.

1.1 Motivation. In this paper we present a framework that includes many well known iterative methods for the solution of nonsymmetric linear systems of equations, Ax = b. Section 2 begins with a brief review of the conjugate gradient method. Next, we describe a broader class of methods, known as projection methods, to which the conjugate gradient (CG) method and most conjugate gradient-like methods belong. The concept of a method having either a fixed or a variable metric is introduced. Methods that have a metric are referred to as either fixed or variable metric methods. Some relationships between projection methods and fixed (variable) metric methods are discussed. The main emphasis of the remainder of this paper is on variable metric methods. In Section 3 we show how the biconjugate gradient (BCG), and the quasi-minimal residual (QMR) methods fit into this framework as variable metric methods. By modifying the underlying Lanczos biorthogonalization process used in the implementation of BCG and QMR, we obtain other variable metric methods. These, we refer to as generalizations of BCG and QMR.

28938 (LA-UR–94-2128) **Independent Validation and Verification of automated information systems in the Department of Energy.** Hunteman, W.J. (Los Alamos National Lab., NM (United States)); Caldwell, R. Los Alamos National Lab., NM (United States). [1994]. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-9410140–1: 17. national computer security conference, Baltimore, MD

(United States), 11-14 Oct 1994). Order Number DE94014460. Source: OSTI; NTIS; GPO Dep.

The Department of Energy (DOE) has established an Independent Validation and Verification (IV&V) program for all classified automated information systems (AIS) operating in compartmented or multi-level modes. The IV&V program was established in DOE Order 5639.6A and described in the manual associated with the Order. This paper describes the DOE IV&V program, the IV&V process and activities, the expected benefits from an IV&V, and the criteria and methodologies used during an IV&V. The first IV&V under this program was conducted on the Integrated Computing Network (ICN) at Los Alamos National Laboratory and several lessons learned are presented. The DOE IV&V program is based on the following definitions. An IV&V is defined as the use of expertise from outside an AIS organization to conduct validation and verification studies on a classified AIS. Validation is defined as the process of applying the specialized security test and evaluation procedures, tools, and equipment needed to establish acceptance for joint usage of an AIS by one or more departments or agencies and their contractors. Verification is the process of comparing two levels of an AIS specification for proper correspondence (e.g., security policy model with top-level specifications, top-level specifications with source code, or source code with object code).

28939 (LBL–35282) **Accountability for network backup failures.** Benson, W.H. Lawrence Berkeley Lab., CA (United States). Feb 1994. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00098. (CONF-9410102–1: 12. annual Pacific Northwest software quality conference, Portland, OR (United States), 17-19 Oct 1994). Order Number DE94011365. Source: OSTI; NTIS; GPO Dep.

Regular hard disk backups for workstations are widely recommended. The necessity of backups – akin to one's own mortality – is something most people would rather not think about. This attitude has two consequences. When people do subscribe to automated network backups, they expect the system to perform at a high level of reliability and that their files will be there for them when they need them. Second, they usually fail to appreciate that reliability is a shared responsibility. Although ostensibly their only responsibility is to keep the computer powered on overnight, there are actually many more opportunities for failure within the user's jurisdiction than in other parts of the infrastructure. High reliability is almost a sine qua non for backups. We describe a strategy for enhancing reliability based on the principle of accountability. This strategy involves monitoring the system, gathering statistics, detecting problems, anticipating problems, troubleshooting, and finally determining where failure occurred within the infrastructure and who should be accountable. We describe a specific backup system in a specific network environment to illustrate the value of accountability. This system, macdumps, backs up Macintosh disks over an AppleTalk network. The original software was written by Dan Tappan of BBN in the early years of the Mac and is available by ftp for noncommercial use. It has proven reliable and robust. Despite the high quality of the fundamental software, there are still many opportunities for failure within the infrastructure. We first discuss accountability in the context of network backups, then briefly describe how the backup system operates, the components of the infrastructure, types of failures experienced, and then summarize our experience.

28940 (ORNL/TM–12507) **Parallel algorithms for the spectral transform method.** Foster, I.T. (Argonne National Lab., IL (United States)); Worley, P.H. Oak Ridge National Lab., TN (United States). Apr 1994. 46p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE94015458. Source: OSTI; NTIS; GPO Dep.

The spectral transform method is a standard numerical technique for solving partial differential equations on a sphere and is widely used in atmospheric circulation models. Recent research has identified several promising algorithms for implementing this method on massively parallel computers; however, no detailed comparison of the different algorithms has previously been attempted. In this paper, we describe these different parallel algorithms and report on computational experiments that we have conducted to evaluate their efficiency on parallel computers. The experiments used a testbed code that solves the nonlinear shallow water equations or a sphere; considerable care was taken to ensure that the experiments provide a fair comparison of the different algorithms and that the results are relevant to global models. We focus on hypercube- and mesh-connected multicomputers with cut-through routing, such as the Intel iPSC/860, DELTA, and Paragon, and the nCUBE/2, but also indicate how the results extend to other parallel computer architectures. The results of this study are relevant not only to the spectral transform method but also to multidimensional FFTs and other parallel transforms.

28941 (ORNL/TM–12764) **A multiple divide-and-conquer (MDC) algorithm for optimal alignments in linear space.** Guan, X.; Uberbacher, E.C. Oak Ridge National Lab., TN (United States). Jun 1994. 13p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE94015457. Source: OSTI; NTIS; GPO Dep.

Dynamic programming algorithms are often used to find the similarities of sequences as well as to deliver the actual alignment of two sequences. Two kinds of alignments are used to compare sequences: local alignments and global alignments. The local alignments attempt to locate conserved regions, while the global alignments identify overall relationship between two sequences. While dynamic programming algorithms are relatively time consuming, the space required is often the limiting factor when aligning long sequences. A linear space algorithm for computing maximal common subsequences, proposed by Hirschberg, was applied by Myers and Miller to deliver optimal alignments in linear space. The authors have improved the Myers and Miller algorithm by introducing a multiple divide and conquer technique that reduces the algorithm's running time while maintaining its linear space property. Efficient sequence alignment algorithms have been an active topic in computational biology.

28942 (OUP–94-07) **Track finding in a Time Projection Chamber with a neural network.** Espe, I.; Engeland, T. Oslo Univ. (Norway). Fysisk Inst. Mar 1994. 20p. Order Number DE94632948. Source: OSTI; NTIS; INIS.

A Hopfield neutral network has been designed in order to reproduce particle tracks in electric and magnetic fields. The main goal is to reproduce tracks from particles in a relativistic heavy ion CERN experiment. In the present work properties of the system are investigated on simulated data. 6 refs., 14 figs., 9 tabs.

28943 (PNL–9872) **System administrator's guide to CDPS: Version 1.0.** Didier, B.T.; Portwood, M.H. Pacific Northwest Lab., Richland, WA (United States). May 1994. 70p. Sponsored by Department of Defense, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE94015288. Source: OSTI; NTIS (US Sales Only); GPO Dep.

The System Administrator's Guide to CDPS is intended for those responsible for setting up and maintaining the hardware and software of a Common Mapping Standard (CMS) Date Production System (CDPS) installation. This guide assists the system administrator in performing typical administrative functions. It is not intended to replace the Ultrix Documentation Set that should be available for a DCPS installation. The Ultrix Documentation Set will be required to provide details on referenced Ultrix commands as well as procedures for performing Ultrix maintenance functions. There are six major sections in this guide. Section 1 introduces the system administrator to CDPS and describes the assumptions that are made by this guide. Section 2 describes the CDPS platform configuration. Section 3 describes the platform preparation that is required to install the CDPS software. Section 4 describes the CPS software and its installation procedures. Section 5 describes the CDS software and its installation procedures. Section 6 describes various operation and maintenance procedures. Four appendices are also provided. Appendix A contains a list of used acronyms. Appendix B provides a terse description of common Ultrix commands that are used in administrative functions. Appendix C provides sample CPS and CDS configuration files. Appendix D provides a required list and a recommended list of Ultrix software subsets for installation on a CDPS platform.

28944 (PNL-SA–24486) **Low latency remote memory access on the Intel Paragon.** Rosing, M. (Pacific Northwest Lab.,

Richland, WA (United States)); Pierce, P. Pacific Northwest Lab., Richland, WA (United States). 20 Jun 1994. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. (CONF-9406205–1: Intel supercomputing users group meeting, San Diego, CA (United States), 25-29 Jun 1994). Order Number DE94014993. Source: OSTI; NTIS; GPO Dep.

We describe a cooperative project between Pacific Northwest Laboratory and Intel on providing low latency communications on the Intel Paragon. Our interest is in developing modules that are tailored to specific types of communication and are optimized for these cases. The modules described are implemented as simple extensions to the Paragon operating system. The first extension supports remote reads, writes, and accumulates on subsections of matrices. This module is intended to be used where the communication pattern is not known until run time. The second extension is designed to support low latency communication for short messages in a pipelined fashion. Finally, an interface for doing highly structured communication where the patterns of communication are well understood ahead of time is described. This is intended to be used in global communications such as global reduction.

28945 (RFP–4728) **Chemical tracking at the Rocky Flats Plant.** Costain, D.B. EG and G Rocky Flats, Inc., Golden, CO (United States). Rocky Flats Plant. [1994]. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC34-90RF62349. (CONF-9405126–1: EG&G GOCO environmental conference, Las Vegas, NV (United States), 10-12 May 1994). Order Number DE94009982. Source: OSTI; NTIS; GPO Dep.

EG&G Rocky Flats, Inc., has developed a chemical tracking system to support compliance with the Emergency Planning and community Right-to-Know Act (EPCRA) at the Rocky Flats Plant. This system, referred to as the EPCRA Chemical Control system (ECCS), uses bar code technology to uniquely identify and track the receipt, distribution, and use of chemicals. Chemical inventories are conducted using hand-held electronic scanners to update a site wide chemical database on a VAX 6000 computer. Information from the ECCS supports preparation of the EPCRA Tier II and Form R reports on chemical storage and use.

28946 (SAND–94-1156C) **Alarm annunciation in a graphical environment.** Adams, D.G. Sandia National Labs., Albuquerque, NM (United States). [1994]. 4p. Sponsored by Department of Defense, Washington, DC (United States);USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. (CONF-940748–14: Institute of Nuclear Materials Management annual meeting, Naples, FL (United States), 17-20 Jul 1994). Order Number DE94015761. Source: OSTI; NTIS; GPO Dep.

Well-designed graphical user interfaces, such as Microsoft Windows™ or UNIX™ – based X-Windows, provide a capability for enhanced display of security alarm information. Conversely, a poorly designed interface can quickly overwhelm an operator. This paper describes types of graphical information that can be displayed and offers guidance on how to best display that information. Limits are proposed for the complexity of the user interface, and guidelines are suggested for the display of maps and sensors.

28947 (SAND–94-1384C) **Learning unions of boxes with membership and equivalence queries.** Goldberg, P.W. (Sandia National Laboratories, Albuquerque, NM (United States)); Goldman, S.A.; Mathias, H.D. Sandia National Labs., Albuquerque, NM (United States). [1994]. 10p. Sponsored by USDOE, Washington, DC (United States);National Science Foundation, Washington, DC (United States). DOE Contract AC04-94AL85000. Grant CCR-9110108; Grant CCR-9357707. (CONF-940794–2: Conference on computational learning theory, New Brunswick, NJ (United States), 10-15 Jul 1994). Order Number DE94014662. Source: OSTI; NTIS; GPO Dep.

The authors present two algorithms that use membership and equivalence queries to exactly identify the concepts given by the union of s discretized axis-parallel boxes in d-dimensional discretized Euclidean space where there are n discrete values that each coordinate can have. The first algorithm receives at most sd counterexamples and uses time and membership queries polynomial in s and log n for d any constant. Further, all equivalence queries made can be formulated as the union of O(sd log(s)) axis-parallel boxes. Next, they introduce a new complexity measure that better captures the complexity of a union of boxes than simply the number of boxes and dimensions. Their new measure, σ, is the number of segments in the target polyhedron where a segment is a maximum portion of one of the sides of the polyhedron that lies entirely inside or entirely outside each of the other halfspaces defining the polyhedron. They then present an improvement of their first algorithm that uses time and queries polynomial in σ and log n. The hypothesis class used here is decision trees of height at most 2sd. Further they can show that the time and queries used by this algorithm are polynomial in d and log n for s any constant thus generalizing the exact learnability of DNF formulas with a constant number of terms. In fact, this single algorithm is efficient for either s or d constant.

28948 (SAND–94-1556C) **Key management for large scale end-to-end encryption.** Witzke, E.L. (RE/SPEC, Inc., Albuquerque, NM (United States)); Pierson, L.G. Sandia National Labs., Albuquerque, NM (United States). [1994]. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. (CONF-9410105–4: Institute of Electrical and Electronics Engineers international Carnahan conference on security technology, Albuquerque, NM (United States), 12-14 Oct 1994). Order Number DE94014284. Source: OSTI; NTIS; GPO Dep.

Symmetric end-to-end encryption requires separate keys for each pair of communicating confidants. This is a problem of Order N^2. Other factors, such as multiple sessions per pair of confidants and multiple encryption points in the ISO Reference Model complicate key management by linear factors. Public-key encryption can reduce the number of keys managed to a linear problem which is good for scaleability of key management, but comes with complicating issues and performance penalties. Authenticity is the primary ingredient of key management. If each potential pair of communicating confidants can authenticate data from each other, then any number of public encryption keys of any type can be communicated with requisite integrity. These public encryption keys can be used with the corresponding private keys to exchange symmetric cryptovariables for high data rate privacy protection. The Digital Signature Standard (DSS), which has been adopted by the United States Government, has both public and private components, similar to a public-key cryptosystem. The Digital Signature Algorithm of the DSS is intended for authenticity but not for secrecy. In this paper, the authors will show how the use of the Digital Signature Algorithm combined with both symmetric and asymmetric (public-key) encryption techniques can provide a practical solution to key management scaleability problems, by reducing the key management complexity to a problem of order N, without sacrificing the encryption speed necessary to operate in high performance networks.

28949 (SAND–94-1582C) **Active messages versus explicit message passing under SUNMOS.** Riesen, R. (Sandia National Labs., Albuquerque, NM (United States)); Wheat, S.R.; Maccabe, A.B. Sandia National Labs., Albuquerque, NM (United States). [1994]. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. (CONF-9406205–3: Intel supercomputing users group meeting, San Diego, CA (United States), 25-29 Jun 1994). Order Number DE94015278. Source: OSTI; NTIS; GPO Dep.

In the past few years much effort has been devoted to finding faster and more convenient ways to exchange data between nodes of massively parallel distributed memory machines. One such approach, taken by Thorsten von Eicken et al. is called Active Messages. The idea is to hide message passing latency and continue to compute while data is being sent and delivered. The authors have implemented Active Messages under SUNMOS for the Intel Paragon and performed various experiments to determine their efficiency and utility. In this paper they concentrate on the subset of the Active Message layer that is used by the implementation of the Split-C library. They compare performance to explicit message passing under SUNMOS and explore new ways to support Split-C without Active Messages. They also compare the implementation to the original one on the Thinking Machines CM-5 and try to determine what the effects of low latency and low bandwidth versus high latency and high bandwidth are on user codes.

28950 (SAND–94-1583C) **SUNMOS for the Intel Paragon - a brief user's guide.** Maccabe, A.B. (Univ. of New Mexico, Albuquerque, NM (United States)); Riesen, R.; McCurley, K.S.; Wheat, S.R. Sandia National Labs., Albuquerque, NM (United States). [1994]. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. (CONF-9406205–2: Intel supercomputing users group meeting, San Diego, CA (United States), 25-29 Jun 1994). Order Number DE94015277. Source: OSTI; NTIS; GPO Dep.

SUNMOS is an acronym for Sandia/UNM Operating System. It was originally developed for the nCUBE-2 MIMD supercomputer between January and December of 1991. Between April and August of 1993, SUNMOS was ported to the Intel Paragon. This document provides a quick overview of how to compile and run jobs using the SUNMOS environment on the Paragon. The primary goal of SUNMOS is to provide high performance message passing and process support an example of its capabilities, SUNMOS Release 1.4 occupies approximately 240K of memory on a Paragon node, and is able to send messages at bandwidths of 165 megabytes per second with latencies as low as 42 microseconds using Intel NX calls. By contrast, Release 1.2 of OSF/1 for the Paragon occupies approximately 7 megabytes of memory on a node, has a peak bandwidth of 65 megabytes per second, and latencies as low as 42 microseconds (the communication numbers are reported elsewhere in these proceedings).

28951 (SAND–94-1796C) **Can information surety be assessed with high confidence?.** Lim, J.J.; Fletcher, S.K.; Halbgewachs, R.D.; Jansma, R.M.; Sands, P.D.; Watterberg, P.A.; Wyss, G.D. Sandia National Labs., Albuquerque, NM (United States). [1994]. 13p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. (CONF-940788–3: High consequence operations safety symposium, Albuquerque, NM (United States), 12-14 Jul 1994). Order Number DE94015805. Source: OSTI; NTIS; INIS; GPO Dep.

Several basic reasons are given to support the position that an integrated, systems methodology entailing probabilistic assessment offers the best means for addressing the problems in software safety. The recognized hard problems in software safety, or safety per se, and some of the techniques for hazard identification and analysis are then discussed relative to their specific strengths and limitations. The paper notes that it is the combination of techniques that will lead to safer systems, and that more experience, examples, and applications of techniques are needed to understand the limits to which software safety can be assessed. Lastly, some ongoing project work at Sandia National Laboratories on developing a solution methodology is presented.

28952 (SAND–94-8227) **Test applications for heterogeneous real-time network testbed.** Mines, R.F.; Knightly, E.W. Sandia National Labs., Livermore, CA (United States). Jul 1994. 18p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. (CONF-941071–2: 9. ACM SIGPLAN conference on object-oriented programming system, languages and applications, Portland, OR (United States), 27 Oct 1994). Order Number DE94016480. Source: OSTI; NTIS; GPO Dep.

This paper investigates several applications for a heterogeneous real-time network testbed. The network is heterogeneous in terms of network devices, technologies, protocols, and algorithms. The network is real-time in that its services can provide per-connection end-to-end performance guarantees. Although different parts of the network use different algorithms, all components have the necessary mechanisms to provide performance guarantees: admission control and priority scheduling. Three applications for this network are described in this paper: a video conferencing tool, a tool for combustion modeling using distributed computing, and an MPEG video archival system. Each has minimum performance requirements that must be provided by the network. By analyzing these applications, we provide insights to the traffic characteristics and performance requirements of practical real-time loads.

28953 (UCRL-JC–116227) **Production control system: A resource management and load leveling system for mainframe computers.** Wood, R.R. Lawrence Livermore National Lab., CA (United States). Mar 1994. 16p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-940392–2: Cray User's meeting, San Diego, CA (United States), 14-18 Mar 1994). Order Number DE94015722. Source: OSTI; NTIS; GPO Dep.

The Livermore Computing Production Control System, commonly called the PCS is described in this paper. The intended audiences for this document are system administrators and resource managers of computer systems. In 1990, the Livermore Computing Center committed itself to convert its supercomputer operations from the New Livermore TimeSharing System (NLTSS) to UNIX based systems. This was a radical change for Livermore Computing in that over thirty years had elapsed during which the only operating environments used on production platforms were LTSS and then later NLTSS. Elaborate, and sometimes obscure, paradigms (to others) were developed to help the lab's scientists productively use the machines and to accurately account for their use to government oversight agencies. Resource management is difficult in typical UNIX and related systems. The weakness involves the allocation, control and delivery of the usage of computer resources. This is a result of the origins and subsequent development of UNIX which started as a system for small platforms in a collegial or departmental atmosphere without stringent or complex budgetary requirements. Accounting also is weak, being generally limited to reporting that a user used an amount of time on a process. A process accounting record is made only after the completion of a process and then only if the process does not terminate as a result of a system "panic."

28954 (UCRL-JC–116229) **Sorting and hardware assisted rendering for volume visualization.** Stein, C.; Becker, B.; Max, N. Lawrence Livermore National Lab., CA (United States). Mar 1994. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-941085–2: Visualization '94, Washington, DC (United States), 17-21 Oct 1994). Order Number DE94010204. Source: OSTI; NTIS; GPO Dep.

We present some techniques for volume rendering unstructured data. Interpolation between vertex colors and opacities is performed using hardware assisted texture mapping, and color is integrated for use with a volume rendering system. We also present an $O(n^2)$ method for sorting n arbitrarily shaped convex polyhedra prior to visualization. It generalizes the Newell, Newell and Sancha sort for polygons to 3-D volume elements.

28955 (UCRL-JC–116231) **Visualizing 3D velocity fields near contour surfaces.** Max, N.; Crawfis, R.; Grant, C. Lawrence Livermore National Lab., CA (United States). Mar 1994. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-941085–1: Visualization '94, Washington, DC (United States), 17-21 Oct 1994). Order Number DE94010205. Source: OSTI; NTIS; GPO Dep.

Vector field rendering is difficult in 3D because the vector icons overlap and hide each other. We propose four different techniques for visualizing vector fields only near surfaces. The first uses motion blurred particles in a thickened region around the surface. The second uses a voxel grid to contain integral curves of the vector field. The third uses many antialiased lines through the surface, and the fourth uses hairs sprouting from the surface and then bending in the direction of the vector field. All the methods use the graphite pipeline, allowing real time rotation and interaction, and the first two methods can animate the texture to move in the flow determined by the velocity field.

28956 (UCRL-JC–116238) **DDI, The Data and Dimensions Interface.** Anderson, C.L.; Drach, R.; Williams, D.N. Lawrence Livermore National Lab., CA (United States). Apr 1994. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-941085–4: Visualization '94, Washington, DC (United States), 17-21 Oct 1994). Order Number DE94014750. Source: OSTI; NTIS; GPO Dep.

The Data and Dimensions Interface (DDI) addresses a significant problem in the visualization of large datasets: Extracting only the relevant data and providing it to a chosen destination in the required form without significant effort. Many different research communities have developed formats for storing and retrieving scientific data and its associated information. These format, while similar in their intent, are not intercompatible. Lack of support for

these formats in commercial visualization systems has been an impediment to their use. Data file size may also cause problems; while sometimes generated on supercomputers, these files are often visualized on smaller machines. DDI was developed as a collaboration between the Program for Climate Model Diagnosis and Intercomparison (PCMDI) and the National Energy Research Supercomputer Center (NERSC), both of Lawrence Livermore National Laboratory (LLNL). DDI was inspired by the PCMDI Graphics Package, as well as NCSA Collage.

28957 (UCRL-JC–116618) **Avoiding BDF stability barriers in the MOL solution of advection-dominated problems.** Hindmarsh, A.C. Lawrence Livermore National Lab., CA (United States). Apr 1994. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-940719–6: World congress on computational and applied mathematics, Atlanta, GA (United States), 11-15 Jul 1994). Order Number DE94014793. Source: OSTI; NTIS; GPO Dep.

In the Method of Lines treatment of advection-dominated PDE problems, the resulting ODE system is typically characterized by weakly damped but strongly oscillatory modes. When a Backward Differentiation Formula (BDF) method is used on such a system, the step size may be unduly limited by the absolute stability region if the order is three or more. Existing BDF codes, which are heavily used in MOL applications generally, often perform poorly in this situation. The scaled derivatives that the BDF solver normally carries for error control purposes are also used for order selection, but until now no BDF solver has included a direct attempt to detect the presence of this stability limit. In an earlier paper , we analyze the scaled derivatives arising in the case where the numerical solution is completely dominated by a fixed, mildly damped, oscillatory mode, and this leads to a procedure for detecting the stability limit. The procedure is applied to the norms of the scaled derivatives of the solution and gives a value for the size of the dominant characteristic root. Stand-alone tests of the procedure on data from a simple ODE of size 2 were very encouraging. Here we use that procedure to form an algorithmic addition to the order selection scheme of the Adams/BDF solver VODE, whereby the order is reduced when a stability limitation is detected with BDF. This algorithm has been installed in an experimental version of VODE. We use a simple advection-diffusion PDE in one space dimension to test the algorithm. In the tests so far, the order is successfully reduced at appropriate times, resulting in considerable savings over the unaltered solver.

28958 (UCRL-JC–116641) **Developing molecular dynamics simulation codes using mixed language programming.** DeBoni, T. (Lawrence Livermore National Lab., CA (United States)); Feo, J.T.; Caffey, H.; Hausheer, F. Lawrence Livermore National Lab., CA (United States). May 1994. 13p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-9405200–1: DIMACS workshop on the specification of parallel algorithms, Princeton, NJ (United States), 9-11 May 1994). Order Number DE94015456. Source: OSTI; NTIS; GPO Dep.

We describe our experiences parallelizing a large-scale scientific application to model systems of discrete particles. We describe the approach and tasks undertaken to parallelize this application using two different programming paradigms: imperative and functional. The objectives of both exercises were to maximize performance, parallelism and portability, and to minimize program development costs. We believe this study reveals an important relationship between conventional and novel parallel programming paradigms, and identifies important attributes that novel paradigms must have to gain wide acceptance.

28959 (UCRL-MA–115604) **The console password feature for DEC workstations.** Van Lehn, A.L. Lawrence Livermore National Lab., CA (United States). Oct 1993. 16p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. Order Number DE94015721. Source: OSTI; NTIS; GPO Dep.

New VAXstations and all DECstations offer a "hardware" password feature that, when enabled, restricts unauthorized access to your system console terminal when turned on or restarted. VAXstation 3100s shipped after July, 1989 offer this feature. A description of this feature should be part of the Hardware User Guide for your workstation; however, some of the early systems did not document this security enhancement. This document is based on the author's investigation as well as information provided by the Digital Equipment Corporation.

28960 (WSRC-MS–94-0112) **Essential elements of an effective data qualification.** Jenkins, E.W. Westinghouse Savannah River Co., Aiken, SC (United States). [1994]. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035. (CONF-940748–21: Institute of Nuclear Materials Management annual meeting, Naples, FL (United States), 17-20 Jul 1994). Order Number DE94015566. Source: OSTI; NTIS; INIS; GPO Dep.

Before data is used in any statistical evaluation, it should be subjected to a thorough data qualification to ensure its integrity. Data Qualification efforts may vary in scope but should all contain certain basic elements. Outliers should be eliminated so that any estimates obtained from the data will not be overly biased. Plots may be generated to uncover potential outliers, and these observations can be confirmed as being anomalous through the use of statistical testing. Non-stationarity of the data (i.e., time trends) may also be initially identified through the use of plots and confirmed by the results of statistical analyses, e.g., the use of the Kendall's tau statistic. When the dataset has been qualified, replicates and duplicates should be averaged to create a pseudo-independence between data points. An algorithm based on the groundwater data from the Savannah River Site has been used by the Applied Statistics Group at Westinghouse Savannah River Company for this.

28961 (WSRC-MS–94-0153P) **The uncertainties in estimating measurement uncertainties.** Clark, J.P.; Shull, A.H. Westinghouse Savannah River Co., Aiken, SC (United States). [1994]. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035. (CONF-940748–24: Institute of Nuclear Materials Management annual meeting, Naples, FL (United States), 17-20 Jul 1994). Order Number DE94015557. Source: OSTI; NTIS; INIS; GPO Dep.

All measurements include some error. Whether measurements are used for accountability, environmental programs or process support, they are of little value unless accompanied by an estimate of the measurements uncertainty. This fact is often overlooked by the individuals who need measurements to make decisions. This paper will discuss the concepts of measurement, measurements errors (accuracy or bias and precision or random error), physical and error models, measurement control programs, examples of measurement uncertainty, and uncertainty as related to measurement quality. Measurements are comparisons of unknowns to knowns, estimates of some true value plus uncertainty; and are no better than the standards to which they are compared. Direct comparisons of unknowns that match the composition of known standards will normally have small uncertainties. In the real world, measurements usually involve indirect comparisons of significantly different materials (e.g., measuring a physical property of a chemical element in a sample having a matrix that is significantly different from calibration standards matrix). Consequently, there are many sources of error involved in measurement processes that can affect the quality of a measurement and its associated uncertainty. How the uncertainty estimates are determined and what they mean is as important as the measurement. The process of calculating the uncertainty of a measurement itself has uncertainties that must be handled correctly. Examples of chemistry laboratory measurement will be reviewed in this report and recommendations made for improving measurement uncertainties.

28962 (WSRC-MS–94-0341) **Three-dimensional modeling of subsurface contamination: A case study from the radio frequency-heating demonstration at the Savannah River Site.** Poppy, S.P. (South Carolina Univ., Aiken, SC (United States)); Eddy-Dilek, C.A.; Jarosch, T.R. Westinghouse Savannah River Co., Aiken, SC (United States). [1994]. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035. (CONF-940815–70: International nuclear and hazardous waste management conference, Atlanta, GA (United States), 14-18 Aug 1994). Order Number DE94015548. Source: OSTI; NTIS; INIS; GPO Dep.

Computer based three-dimensional modeling is a powerful tool used for visualizing and interpreting environmental data collected at the Savannah River Site (SRS). Three-dimensional modeling was used to image and interpret subsurface spatial data, primarily, changes in the movement, the accumulation, and the depletion of contaminants at the Integrated Demonstration Site (IDS), a proving ground for experimental environmental remediation technologies. Three-dimensional models are also educational tools, relaying complex environmental data to interested non-technical individuals who may be unfamiliar with the concepts and terminology involved in environmental studies. The public can draw their own conclusions of the success of the experiments after viewing the three-dimensional images set up in a chronological order. The three-dimensional grids generated during these studies can also be used to create images for visualization and animated sequences that model contamination movement. Animation puts the images of contamination distribution in motion and results in a new perspective on the effects of the remedial demonstration.

9903 Information Handling

Refer also to citation(s) 27540, 27544, 27623, 27697, 27824, 28287, 28295, 28747, 28757, 28944

28963 (ANL-HEP-CP–94-37) **The PASS project: A progress report.** Quarrie, D.R. (Lawrence Berkeley Lab., CA (United States)); Day, C.T.; Loken, S. Argonne National Lab., IL (United States); Lawrence Berkeley Lab., CA (United States). [1994]. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38 ; AC03-76SF00098. (CONF-940492–10: Meeting on computing in high-energy physics, San Francisco, CA (United States), 21-27 Apr 1994). Order Number DE94016308. Source: OSTI; NTIS; INIS; GPO Dep.

The PASS project has as its goal the implementation of solutions to the foreseen data access problems of the next generation of scientific experiments. It is in the process of transitioning from an exploratory phase, where the focus has been on understanding the requirements and available technologies to an implementation phase, where detailed design work is commencing on a conunon framework for scientific applications.

28964 (ANL-HEP-CP–94-38) **The PASS project architectural model.** Day, C.T. (Lawrence Berkeley Lab., CA (United States)); Loken, S.; Macfarlane, J.F. Argonne National Lab., IL (United States); Lawrence Berkeley Lab., CA (United States). [1994]. 3p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38 ; AC03-76SF00098. (CONF-940492–9: Meeting on computing in high-energy physics, San Francisco, CA (United States), 21-27 Apr 1994). Order Number DE94016309. Source: OSTI; NTIS; INIS; GPO Dep.

The PASS project has as its goal the implementation of solutions to the foreseen data access problems of the next generation of scientific experiments. The architectural model results from an evaluation of the operational and technical requirements and is described in terms of an abstract reference model, an implementation model and a discussion of some design aspects. The abstract reference model describes a system that matches the requirements in terms of its components and the mechanisms by which they communicate, but does not discuss policy or design issues that would be necessary to match the model to an actual implementation. Some of these issues are discussed, but more detailed design and simulation work will be necessary before choices can be made.

28965 (DOE/EIA–0149(93)) **EIA Publications Directory 1993.** USDOE Energy Information Administration, Washington, DC (United States). 18 Jul 1994. 56p. Sponsored by USDOE, Washington, DC (United States). Order Number DE94015840. Source: OSTI; NTIS; INIS; GPO Dep.

This directory contains abstracts and ordering information for EIA publications released in the above time period. The abstracts are arranged by broad subject category such as coal, petroleum, natural gas, and electric power. A comprehensive subject index, a title index, and a report number index are included. Each entry gives the title, report number, publication frequency, date, number of pages, and ordering information.

28966 (DOE/ER/25114–1) **NIST cooperative laboratory for OSI routing technology.** Montgomery, D. National Inst. of Standards and Technology, Gaithersburg, MD (United States). 23 May 1994. 40p. Sponsored by USDOE, Washington, DC (United States);National Science Foundation, Washington, DC (United States). DOE Contract AI05-92ER25114. Grant NCR-9120054. Order Number DE94015308. Source: OSTI; NTIS; GPO Dep.

This document is one of two reports on the Integrated ISIS protocol. Required by the IAB/IESG in order for an Internet routing protocol to advance to Draft Standard Status. Integrated ISIS is an Interior Gateway Protocol and is designed to carry both IP and ISO CLNP routing information. Integrated ISIS is currently designated as a Proposed Standard. The protocol was first published in RFC 1195. Internet Draft was published subsequently to RFC 1195 and documents the current version of the protocol. This report documents experience with Integrated ISIS. This includes reports on interoperability testing, field experience and the current state of Integrated ISIS implementations. It also presents a summary of the Integrated ISIS Management Information Base (MIB), and a summary of the Integrated ISIS authentication mechanism.

28967 (DOE/LLW–201-Rev.1) **FFCAct Clearinghouse, Directory of abstracts: Revision 1.** Harwood, T. EG and G Idaho, Inc., Idaho Falls, ID (United States). May 1994. 64p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE94015259. Source: OSTI; NTIS; INIS; GPO Dep.

The Federal Facility Compliance Act (FFCAct) Clearinghouse is a card catalog of information about the FFCAct and its requirements for developing Site Treatment Plans (STP). The information available in the clearinghouse includes abstracts describing computer applications, technical reports, and a list of technical experts. Information can be accessed for use in responding to FFCAct requirements, and the clearinghouse provides search capabilities on particular topics and issues related to STP development. Appendix A includes: contacts from each site, for which contact has been made, who are developing STPs; the FFCAct Clearinghouse Fact Sheet and; additional hard copy forms to be used to populate the database. This report contains 50 abstracts related to the Radioactive Waste Technical Support Program.

28968 (EGG-CS–11209) **Digital conversion of INEL archeological data using ARC/INFO and Oracle.** Lee, R.D.; Brizzee, J.; White, L. EG and G Idaho, Inc., Idaho Falls, ID (United States). 4 Nov 1993. 28p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE94015322. Source: OSTI; NTIS; GPO Dep.

This report documents the procedures used to convert archaeological data for the INEL to digital format, lists the equipment used, and explains the verification and validation steps taken to check data entry. It also details the production of an engineered interface between ARC/INFO and Oracle.

28969 (PNL-SA–23679) **DOE's Pollution Prevention Information Clearinghouse (EPIC).** Otis, P.T. Pacific Northwest Lab., Richland, WA (United States). May 1994. 19p. Sponsored by USDOE, Washington, DC (United States);Department of Defense, Washington, DC (United States);Environmental Protection Agency, Washington, DC (United States). DOE Contract AC06-76RL01830. (CONF-940578–Summ.: Pollution prevention conference, Denver, CO (United States), 3-5 May 1994). Order Number DE94014570. Source: OSTI; NTIS; INIS; GPO Dep.

The US Department of Energy's (DOE's) Pollution Prevention Information Clearinghouse (EPIC) is a computer system intended for the exchange of pollution prevention information DOE-wide. EPIC is being developed as a distributed system that will allow access to other databases and applications. The first prototype of EPIC (Prototype I) was put on-line in January 1994. Prototype I contains information on EM-funded pollution prevention projects; relevant laws, regulations, guidance, and policy; facility and DOE contacts; and meetings and conferences. Prototype I also gives users access to the INEL Hazardous Solvent Substitution Data System (HSSDS) and to information contained on the US Environmental Protection Agency's (EPNS) Pollution Prevention Infbrmation Exchange System (PIES) as a test of the distributed system concept. An initial user group of about 35 is testing and providing feedback

on Prototype I. Prototype II, with a Graphical User Interface (GUI), is planned for the end of CY94. This paper describes the current state of EPIC in terms of architecture, user interface, and information content. Plans for Prototype II and the final system are then discussed. The EPIC development effort is being coordinated with EPA and US Department of Defense (DoD) efforts to develop or upgrade their pollution prevention information exchange systems.

28970 (UCRL-JC–115069) **Application of decision support systems to environmental restoration processes.** Rice, D.W. Jr. (Lawrence Livermore National Lab., CA (United States)); Ziagos, J.; Bell, D. Lawrence Livermore National Lab., CA (United States). Oct 1993. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-940312–62: 2. Probabilistic safety assessment and management conference (PSAM), San Diego, CA (United States), 20-24 Mar 1994). Order Number DE94014747. Source: OSTI; NTIS; GPO Dep.

The reduction of public health risk due to potential exposure of environmental contaminants is the prime reason for environmental restoration (ER) remedial actions. The potential cost of nationwide ER is enormous. Therefore, there is a great need to (1) identify the types and levels of effort that are appropriate to reducing both the public health risk and the uncertainty associated with the risk and (2) increase the benefit/cost ration of the ER effort to prevent unnecessary expense environmental Decision Support Systems (EDSSs) provide a means to meet these needs. This document discusses the elements of decision support systems.

28971 (UCRL-JC–116424) **Study of magnetic recording media on glass substrates.** Duan, S. (Seagate Magnetics, Fremont, CA (United States)); Zhang, Bing; Gao, Chuan; Rauch, G.C.; Pressesky, J.L.; Schwartz, A. Lawrence Livermore National Lab., CA (United States). 31 Mar 1994. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-940629–8: Intermag: 6th joint conference on magnetism and magnetic materials, Albuquerque, NM (United States), 20-23 Jun 1994). Order Number DE94014740. Source: OSTI; NTIS; GPO Dep.

Magnetic media deposited on glass substrates with metal seedlayer, Cr underlayer and CoCrPtTa alloy were studied. Within each group of samples, although the bulk magnetic properties were made to be similar, the media noise differed significantly; microstructural study indicated that the grain sizes of the magnetic layers were similar. X-ray diffraction study indicated that the magnetic layer was mostly [10.0] textured, with some [00.2] and [10.1] oriented grains also present. A correlation was observed between stronger CoCrPtTa [00.2] diffraction peak and lower media noise; the Cr[200] peak in the lower noise media was also much weaker. The different crystallographic texture is likely promoted by the surface condition of the seedlayer; larger number of [00.2] grains within the mostly [10.0] textured magnetic layer may result in zigzag transitions wi less cross track correlation length, which would result in lower media noise.

9904 Law

Refer also to citation(s) 27825

28972 (AECL–10777, pp. 217-230) **Proposed guide for regulatory assessment of software.** Taylor, R.P. (Atomic Energy Control Board, Ottawa, ON (Canada)). Atomic Energy of Canada Ltd., Chalk River, ON (Canada). Chalk River Nuclear Labs. Feb 1993. (CONF-9209425–: International Working Group on Nuclear Power Plant Control and Instrumentation, Chalk River (Canada), 8-11 Sep 1992). In *Proceedings*. 330p. Order Number DE94632739. Source: OSTI; NTIS (US Sales Only); INIS.

As part of the regulation and licensing of nuclear power plants, AECB (Atomic Energy Control Board) staff are called upon to review and assess software used in systems important to safety. This paper consolidates AECB staff experience over the last few years into a guide for assessing confirmation of the people and the processes used to develop the software, systematic inspection of the software, and review of the testing done on the software. (Author) 10 refs.

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This index is arranged by subject descriptors selected from those assigned to each citation in this publication. Subject descriptors are selected from a controlled thesaurus of terms, ETDE/PUB–2(Rev.1), *International Energy: Subject Thesaurus*. In order to enhance indexing, subject descriptor entries generally consist of a pair of descriptors: a main term and a qualifier term. Each entry includes the full title (which may be followed by supplementary descriptive information in parentheses) and the citation number. Additional information given in parentheses indicates the document type (an abbreviation such as B for book), the country of publication (such as DE for Federal Republic of Germany), and the language if non-English.

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	19:27350	EGG-MS–10941
	19:27351	EGG-RWMC–11190
	19:27352	EGG-WM–10924
	19:27353	EGG-WM–11053
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	19:27355	EGG-WROC–11152
	19:27356	EGG-WTD–11199
	19:27357	EGG-WTD–11208
	19:27358	EGG-WTD–11271
	19:27455	EGG-CIET–11057
	19:27456	EGG-CIET–11058
	19:27457	EGG-WROC–11148
	19:27484	EGG-WM–8773
	19:27485	EGG-WTD–11161
	19:27486	EGG-WTD–11191
	19:27487	EGG-WTD–11310
	19:27488	EGG-WTD–11311
	19:27571	EGG-SSRE–9747
	19:27697	ERA-NRE–94-016
	19:27862	EGG-RAAM–11278
	19:27880	DOE/ID–10293
	19:27881	DOE/ID–10421
	19:27882	DOE/ID–10426
	19:27948	EGG-MS–11063
	19:27967	EGG-NRE–11236
	19:28015	EGG-WM–11011
	19:28072	DOE/FTR–94009531
	19:28387	EGG-ME–11131
	19:28462	EGG-CIET–11270
	19:28516	EGG-CIET–11127
	19:28930	EGG-EE–11298-Pt.1
	19:28931	EGG-EE–11298-Pt.2
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	19:28968	EGG-CS–11209
	Nuclear Regulatory Commission, Washington, DC (United States). Div. of Engineering	
	19:27643	NUREG/CR–6121
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	19:28009	NUREG/CR–6116-Vol.5
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	19:27333	DOE/ID–10453-Pt.1
	19:27533	DOE/ID–10422-Vol.1
	19:27534	DOE/ID–10422-Vol.2
	19:27535	DOE/ID–10422-Vol.3
AC07-84ID12435	**Westinghouse Idaho Nuclear Co., Inc., Idaho Falls, ID (United States)**	
	19:27428	WINCO–1157
	19:27429	WINCO–1162
	19:27430	WINCO–1206
	19:27918	WINCO–1219
	19:28043	WINCO–1218
	19:28372	PATENTS-US–A7942239
AC08-76NV01183	**EG and G, Inc., Las Vegas, NV (United States)**	
	19:27622	EGG–1183-5068
	19:28013	EGG–1183-6
	19:28014	EGG–1183-1218
	19:28298	EGG–1183-2349
	19:28393	EGG–1183-1219
	EG and G Energy Measurements, Inc., Los Alamos, NM (United States). Los Alamos Operations	
	19:27618	EGG–1183-5074
	EG and G Energy Measurements, Inc., Las Vegas, NV (United States)	
	19:28386	EGG–1183-1262
	19:28392	EGG–1183-281
	EG and G, Inc., San Ramon, CA (United States). San Ramon Operations	
	19:28862	EGG–1183-4118
	EG and G Energy Measurements, Inc., San Ramon, CA (United States). San Ramon Operations	
	19:28863	EGG–1183-4119
	Edgerton, Germeshausen and Grier, Inc., Bedford, MA (United States)	
	19:27696	EGG–1183-1022
AC08-88NV10617	**EG and G Energy Measurements, Inc., Las Vegas, NV (United States)**	
	19:28336	PATENTS-US–A7941837
AC08-90NV10845	**Nevada Univ., Las Vegas, NV (United States). Desert Research Inst.**	
	19:28486	DOE/NV/10845–38
AC08-92NV10972	**International Technology, Inc., Las Vegas, NV (United States)**	
	19:27338	DOE/NV–373
AC08-93NV11265	**EG and G Energy Measurements, Inc., Las Vegas, NV (United States)**	
	19:28488	EGG–11265-1012
	19:28489	EGG–11265-2022
	EG and G Energy Measurements, Inc., Goleta, CA (United States). Santa Barbara Operations	
	19:28490	EGG–11265-2059
AC08-94NV11432	**Reynolds Electrical and Engineering Co., Inc., Las Vegas, NV (United States)**	
	19:28461	DOE/NV/11432–139
AC09-76SR00001	**Du Pont de Nemours (E.I.) and Co., Aiken, SC (United States)**	
	19:27274	SR/H–746
	19:27497	PATENTS-US–A7896762
	19:27753	SR/H–747
	19:27755	SR/H–749
	19:27757	SR/H–759
	Du Pont de Nemours (E.I.) and Co., Aiken, SC (United States). Savannah River Lab.	
	19:27756	SR/H–750
	Du Pont de Nemours (E.I.) and Co., Aiken, SC (United States). Savannah River Plant	
	19:27398	SR/H–695

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	Du Pont de Nemours (E.I.) and Co., Wilmington, DE (United States). Engineering Dept.	
	19:27754	SR/H–748
	Du Pont de Nemours (E.I.) and Co., Wilmington, DE (United States). Explosives Dept.	
	19:27483	DPW–55-131
	19:27673	DPW–56-179
	19:27684	DPW–53-1355
	19:27758	SR/H–761
	19:27994	DPW–56-135
AC09-89SR18035	**Science Applications International Corp., San Diego, CA (United States)**	
	19:27482	DPSTSA–200-10-Suppl.4-Del.Ver.
	Westinghouse Savannah River Co., Aiken, SC (United States)	
	19:27362	HLW-OVP–94-0005
	19:27431	WSRC-MS–93-412
	19:27432	WSRC-MS–94-027
	19:27433	WSRC-MS–94-0110
	19:27434	WSRC-MS–94-0133
	19:27435	WSRC-MS–94-0163
	19:27436	WSRC-MS–94-0274
	19:27437	WSRC-MS–94-0328
	19:27438	WSRC-MS–94-0331
	19:27439	WSRC-RP–93-1376
	19:27440	WSRC-TN–6
	19:27441	WSRC-TR–94-075
	19:27442	WSRC-TR–94-100-2
	19:27443	WSRC-TR–94-100-3
	19:27444	WSRC-TR–94-0194-Rev.1
	19:27445	WSRC-TR–94-0227
	19:27446	WSRC-TR–94-0257
	19:27447	WSRC-TR–94-0269
	19:27468	WSRC-MS–94-065(P)
	19:27498	PATENTS-US–A7935950
	19:27525	WSRC-MS–94-0107
	19:27526	WSRC-RP–94-607
	19:27527	WSRC-TR–93-872-Rev.1
	19:27528	WSRC-TR–94-0160
	19:27529	WSRC-TR–94-0179
	19:27560	WSRC-MS–94-0102
	19:27561	WSRC-MS–94-0106
	19:27562	WSRC-RP–93-1262
	19:27570	PATENTS-US–A7933152
	19:27635	WSRC-MS–94-0130
	19:27760	WSRC-MS–94-0352
	19:27761	WSRC-TR–93-659
	19:27762	WSRC-TR–93-682
	19:27763	WSRC-TR–93-685
	19:27764	WSRC-TR–93-690
	19:27765	WSRC-TR–93-695
	19:27780	WSRC-TR–93-614
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	19:27782	WSRC-TR–93-684
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	19:27787	WSRC-TR–93-692
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	19:27789	WSRC-TR–93-694
	19:27816	WSRC-TR–94-0328
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	19:27983	PATENTS-US–A7933151
	19:28005	WSRC-TR–93-454
	19:28268	WSRC-MS–94-0383
	19:28335	PATENTS-US–A7933155
	19:28510	WSRC-MS–94-0113
	19:28524	WSRC-TR–94-0212
	19:28960	WSRC-MS–94-0112
	19:28961	WSRC-MS–94-0153P
	19:28962	WSRC-MS–94-0341
AC12-76SN00052	**Knolls Atomic Power Lab., Schenectady, NY (United States)**	
	19:27900	KAPL–4763
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	19:27902	KAPL–4782
	19:27949	KAPL–4777
	KAPL, Inc., Schenectady, NY (United States)	
	19:28334	PATENTS-US–A7897409
AC21-86MC21023	**Foster Wheeler Development Corp., Livingston, NJ (United States)**	
	19:27220	DOE/MC/21023–94/C0346
AC21-91MC28130	**Scotia Group, Inc., Dallas, TX (United States)**	
	19:27258	DOE/MC/28130–3721
AC21-92MC29246	**Minnesota Univ., Minneapolis, MN (United States)**	
	19:27204	DOE/MC/29246–3773
	19:27205	DOE/MC/29246–3839
AC21-93MC29257	**General Motors Corp., Indianapolis, IN (United States). Allison Gas Turbine Div.**	
	19:27876	DOE/NASA–0336-4
AC21-93MC30171	**Molten Metals Technology, Inc., Waltham, MA (United States)**	
	19:27335	DOE/MC/30171–94/C0344
AC21-93MC30246	**Solar Turbines, Inc., San Diego, CA (United States)**	
	19:27629	DOE/MC/30246–3844
AC22-88ID12735	**Argonne National Lab., IL (United States)**	
	19:27300	ANL/CMT/CP–82133
	MSE, Inc., Butte, MT (United States)	
	19:28485	DOE/ID/12735–T31
AC22-89BC14475	**California Univ., Berkeley, CA (United States)**	
	19:27241	DOE/BC/14475–T1
AC22-89BC14479	**Colorado Univ., Boulder, CO (United States). Dept. of Chemical Engineering**	
	19:27265	DOE/BC/14479–T1
	19:27266	DOE/BC/14479–T2
AC22-89PC88654	**Combustion Engineering, Inc., Windsor, CT (United States)**	
	19:27223	DOE/PC/88654–T8
	19:27224	DOE/PC/88654–T9
	19:27225	DOE/PC/88654–T10
	19:27226	DOE/PC/88654–T11
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	ABB Combustion Engineering, Windsor, CT (United States). Power Plant Labs.	
	19:27229	DOE/PC/88654–T14
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AC22-90PC90055	**UOP, Inc., Des Plaines, IL (United States)**	
	19:27207	DOE/PC/90055–T14
AC22-92PC92111	**Massachusetts Inst. of Tech., Cambridge, MA (United States)**	
	19:27926	DOE/PC/92111–5
AC22-92PC92158	**Riley Stoker Corp., Worcester, MA (United States)**	
	19:27632	DOE/PC/92158–T7
AC22-92PC92159	**ABB/Combustion Engineering, Inc., Windsor, CT (United States)**	
	19:27633	CONF-940320–1
AC34-90DP62349	**EG and G Rocky Flats, Inc., Golden, CO (United States). Rocky Flats Plant**	
	19:27503	RFP–4810

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	19:27504	RFP–4848
AC34-90RF62349	EG and G Rocky Flats, Inc., Golden, CO (United States). Rocky Flats Plant	
	19:28945	RFP–4728
AC36-83CH10093	National Renewable Energy Lab., Golden, CO (United States)	
	19:27257	NREL/TP–425-6355
	19:27592	NREL/TP–463-5607
	19:27596	NREL/CP–413-7033
	19:27597	NREL/TP–411-6855
	19:27598	NREL/TP–411-6864
	19:27599	NREL/TP–413-6853
	19:27600	NREL/TP–451-6491
	19:27601	NREL/TP–451-6862
	19:27602	NREL/TP–451-7045
	19:27603	NREL/TP–451-7047
	19:27606	DOE/FTR–94009143
	19:27625	NREL/TP–440-6628
	19:27627	NREL/TP–441-7044
	19:27798	DOE/FTR–94009138
	19:27872	NREL/TP–430-6078
	19:27878	NREL/TP–425-6161
AC79-89BP80397	Resources for the Future, Inc., Washington, DC (United States)	
	19:27589	DOE/BP/80397–1
AI05-91ER40638	Maryland Univ., College Park, MD (United States)	
	19:28175	DOE/ER/54160–1-Vol.3
AI05-92ER25114	National Inst. of Standards and Technology, Gaithersburg, MD (United States)	
	19:28966	DOE/ER/25114–1
AI08-92NV10874	Geological Survey, Denver, CO (United States)	
	19:27406	USGS-WRI–93-4144
	Geological Survey, Las Vegas, NV (United States)	
	19:27326	CONF-9309228–11
	USDOE Nevada Operations Office, Las Vegas, NV (United States)	
	19:27405	USGS-OFR–94-54
AI79-83BP13084	National Biological Survey, Cook, WA (United States). Columbia River Research Lab.	
	19:27587	DOE/BP/13084–6
AI79-93BP10891	National Marine Fisheries Service, Seattle, WA (United States). Coastal Zone and Estuarine Studies Div.	
	19:27586	DOE/BP/10891–1
BI79-88BP93497	Idaho Dept. of Fish and Game, Boise, ID (United States)	
	19:27590	DOE/BP/93497–T1
BI79-89BP01610	Oregon Dept. of Fish and Wildlife, Portland, OR (United States)	
	19:28512	DOE/BP/01610–2
BI79-90BP07084	Oregon Dept. of Fish and Wildlife, Portland, OR (United States)	
	19:27584	DOE/BP/07084–3
	19:27585	DOE/BP/07084–4
BI79-92BP60559	Montana Dept. of Fish, Wildlife and Parks, Kalispell, MT (United States)	
	19:27588	DOE/BP/60559–1
FC07-85NV10412	Texas Univ., Austin, TX (United States). Bureau of Economic Geology	
	19:27243	DOE/NV/10412–9
	Texas Univ., Austin, TX (United States). Center for Petroleum and Geosystems Engineering	
	19:27621	DOE/NV/10412–10
FC09-88SR15199	South Carolina Univ., Columbia, SC (United States). Savannah River Archaeological Research Program	
	19:28487	DOE/SR/15199–17
FC21-86MC10637	North Dakota Univ., Grand Forks, ND (United States). Energy and Environmental Research Center	
	19:27194	DOE/MC/10637–3820
	19:27201	DOE/MC/10637–3742
FC21-86MC11076	Western Research Inst., Laramie, WY (United States)	
	19:27216	DOE/MC/25038–3817
FC21-87MC24207	West Virginia Univ., Morgantown, WV (United States). Dept. of Mechanical and Aerospace Engineering	
	19:27221	DOE/MC/24207–3322
	19:27222	DOE/MC/24207–3473
FC21-89MC26042	American Electric Power Service Corp., Columbus, OH (United States)	
	19:27203	DOE/MC/26042–3806
FC22-90PC89659	Babcock and Wilcox Co., Cassville, WI (United States)	
	19:27630	DOE/PC/89659–T16-App.-Bk.1
FC22-91PC90544	Stone and Webster Engineering Corp., Englewood, CO (United States)	
	19:27631	DOE/PC/90544–T13
	Alaska Industrial Development and Export Authority, Anchorage, AK (United States)	
	19:27211	DOE/PC/90544–T14
FC22-91PC90547	Energy and Environmental Research Corp., Irvine, CA (United States)	
	19:27634	DOE/PC/90547–T15
FC22-92PC92521	Illinois Dept. of Energy and Natural Resources, Springfield, IL (United States)	
	19:27197	DOE/PC/92521–T153
FG01-93EW53023	Tulane Univ., New Orleans, LA (United States)	
	19:28515	DOE/EW/53023–T7
FG02-85CE40772	Purdue Univ., Lafayette, IN (United States)	
	19:27963	CONF-9303281–1
FG02-85ER53194	Dartmouth Coll., Hanover, NH (United States)	
	19:28802	DOE/ER/53194–4
FG02-85ER53198	Wisconsin Univ., Madison, WI (United States). Plasma Physics Research	
	19:28851	DOE/ER/53198–242
	19:28852	DOE/ER/53198–243
	19:28853	DOE/ER/53198–244
FG02-85ER53212	Wisconsin Univ., Madison, WI (United States). Plasma Physics Research	
	19:28803	DOE/ER/53212–241
FG02-85ER60372	Columbia Univ., Palisades, NY (United States). Lamont-Doherty Earth Observatory	
	19:28460	DOE/ER/60372–9
FG02-86ER13508	Cornell Univ., Ithaca, NY (United States). School of Applied and Engineering Physics	
	19:28762	DOE/ER/13508–8
FG02-87ER45308	Colorado School of Mines, Golden, CO (United States). Center for Welding and Joining Research	
	19:27889	DOE/ER/45308–7
FG02-87ER45328	Cornell Univ., Ithaca, NY (United States). Dept. of Materials Science and Engineering	
	19:27890	DOE/ER/45328–8
FG02-88ER13974	Cornell Univ., Ithaca, NY (United States)	
	19:27945	DOE/ER/13974–T2
FG02-88ER45364	Cornell Univ., Ithaca, NY (United States). Lab. of Atomic and Solid State Physics	
	19:28770	DOE/ER/45364–T4

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FG02-88ER45366	Michigan Univ., Ann Arbor, MI (United States)	
	19:27946	DOE/ER/45366–6
FG02-88ER60634	Nebraska Univ., Lincoln, NE (United States). Dept. of Physics	
	19:28550	DOE/ER/60634–T5
FG02-89ER14052	Maryland Univ., College Park, MD (United States)	
	19:28182	DOE/ER/54160–1-Vol.3
	19:28183	DOE/ER/54160–1-Vol.3
	Massachusetts Inst. of Tech., Cambridge, MA (United States)	
	19:28168	DOE/ER/14052–1
FG02-90ER61033	Brookhaven National Lab., Upton, NY (United States)	
	19:28343	BNL–60593
FG02-91CE23810	National Inst. of Standards and Technology, Boulder, CO (United States). Thermophysics Div.	
	19:27944	DOE/CE/23810–42A
	Spauschus Associates, Inc., Stockbridge, GA (United States)	
	19:27988	DOE/CE/23810–34
FG02-91ER20041	Ohio State Univ., Columbus, OH (United States). Dept. of Microbiology	
	19:28526	DOE/ER/20041–2
FG02-91ER40609	Argonne National Lab., IL (United States)	
	19:28680	ANL/PHY/CP–83297
	19:28681	ANL/PHY/CP–83538
FG02-91ER40684	Northwestern Univ., Evanston, IL (United States)	
	19:28597	DOE/ER/40684–4
FG02-92ER14302	Pennsylvania State Univ., University Park, PA (United States)	
	19:28011	CONF-940684–4
FG02-92ER20062	Illinois Univ., Urbana, IL (United States)	
	19:28536	CONF-9205407–Absts.
FG02-92ER30201	Consultec Scientific, Inc., Knoxville, TN (United States)	
	19:27992	DOE/ER–30201-H1-Vol.1
	19:27993	DOE/ER–30201-H1-Vol.2
FG02-92ER40747	Indiana Univ., Bloomington, IN (United States). Dept. of Physics	
	19:28125	DOE/ER/40747–10
FG02-92ER54157	New York Univ., NY (United States). Courant Inst. of Mathematical Sciences	
	19:28804	DOE/ER/54157–3
FG02-92ER54181	Rensselaer Polytechnic Inst., Troy, NY (United States). Dept. of Nuclear Engineering and Engineering Physics	
	19:28859	DOE/ER/54181–2
FG02-92ER61395	Eunice Kennedy Shriver Center for Mental Retardation, Inc., Waltham, MA (United States). Div. of Medical Genetics	
	19:28537	DOE/ER/61395–T2
FG02-92ER61464	State Univ. of New York, Stony Brook, NY (United States). Marine Sciences Research Center	
	19:28513	DOE/ER/61464–2
FG02-92ER61502	Eleanor Roosevelt Inst., Denver, CO (United States)	
	19:28529	DOE/ER/61502–1
FG02-92ER75728	Michigan Univ., Ann Arbor, MI (United States). Dept. of Nuclear Engineering	
	19:27660	DOE/ER/75728–2
FG02-93ER14328	Wisconsin Univ., Madison, WI (United States). Dept. of Geology and Geophysics	
	19:28483	DOE/ER/14328–1
FG02-93ER25176	Wisconsin Univ., Madison, WI (United States). Dept. of Computer Sciences	
	19:28928	DOE/ER/25176–1
FG02-93ER40768	Brookhaven National Lab., Upton, NY (United States)	
	19:28714	BNL–60633
FG02-93ER61716	Columbia Univ., Palisades, NY (United States). Lamont-Doherty Earth Observatory	
	19:28514	DOE/ER/61716–1
FG02-94ER40848	Argonne National Lab., IL (United States)	
	19:28681	ANL/PHY/CP–83538
FG03-86ER52123	Los Alamos National Lab., NM (United States)	
	19:28872	LA-UR–94-2563
FG03-89ER45400	Rockwell International Corp., Thousand Oaks, CA (United States). Science Center	
	19:27943	CONF-940399–1
	19:27947	DOE/ER/45400–T6
FG03-92ER54150	General Atomics, San Diego, CA (United States)	
	19:28821	GA-A–21347
	19:28822	GA-A–21466
	19:28823	GA-A–21523
FG03-92ER61484	New Mexico Inst. of Mining and Technology, Socorro, NM (United States)	
	19:28484	DOE/ER/61484–08
FG03-93ER40759	California Univ., San Diego, CA (United States)	
	19:28169	DOE/ER/40759–2
FG03-94ER54241	Texas Univ., Austin, TX (United States)	
	19:28819	DOE/ER/54241–131
	Texas Univ., Austin, TX (United States). Fusion Research Center	
	19:28820	DOE/ER/54241–132
FG05-80ET53088	Texas Univ., Austin, TX (United States). Inst. for Fusion Studies	
	19:28638	DOE/ET/53088–665
FG05-85ER13387	Texas Univ., Austin, TX (United States). Dept. of Chemistry	
	19:27595	DOE/ER/13387–74
FG05-85ER13439	Rice Univ., Houston, TX (United States)	
	19:28007	DOE/ER/13439–T4
FG05-86ER13591	Tennessee Univ., Knoxville, TN (United States)	
	19:27964	DOE/ER/13591–8
FG05-86ER40270	George Washington Univ., Washington, DC (United States)	
	19:28720	DOE/ER/40270–53
FG05-88ER53267	Texas Univ., Austin, TX (United States). Fusion Research Center	
	19:28820	DOE/ER/54241–132
FG05-89ER53288	North Carolina Univ., Asheville, NC (United States). Dept. of Physics	
	19:28801	CONF-920362–49
FG05-90ER14103	National Academy of Sciences - National Research Council, Washington, DC (United States)	
	19:27990	DOE/ER/14103–T1
FG05-91ER14213	Rice Univ., Houston, TX (United States). Dept. of Space Physics and Astronomy	
	19:28763	DOE/ER/14213–4
FG05-92ER14291	Louisiana State Univ., Baton Rouge, LA (United States). Dept. of Chemical Engineering	
	19:27987	CONF-940744–5
	19:27991	DOE/ER/14291–T1
FG06-89ER75522	Pacific Northwest Lab., Richland, WA (United States)	
	19:28500	PNL-SA–24175

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FG05-90ER40561	**Washington Univ., Seattle, WA (United States). Inst. for Nuclear Theory**	
	19:28613	DOE/ER/40561–147
FG06-92ER14252	**Washington State Univ., Pullman, WA (United States). Dept. of Physics**	
	19:27965	DOE/ER/14252–1
	19:27966	DOE/ER/14252–2
FG07-89ID12842	**Louisiana State Univ., Baton Rouge, LA (United States)**	
	19:27242	DOE/ID/12842–3
FG09-84ER13296	**South Carolina Univ., Columbia, SC (United States). Dept. of Chemistry**	
	19:27989	DOE/ER/13296–10
FG09-87ER13811	**Georgia Univ., Athens, GA (United States). Research Foundation**	
	19:28371	DOE/ER/13811–6
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81718	19:28049	OSTI; NTIS; GPO Dep.	E 1.99:	DE94016300	MF-1425
82151	19:27304	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94015031	MF-902
82304	19:28787	OSTI; NTIS; GPO Dep.	E 1.99:	DE94015089	MF-1393; MF-404
82348	19:27919	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94015067	MF-1390
82796	19:27200	OSTI; NTIS; GPO Dep.	E 1.99:	DE94015075	MF-104; MF-404
83581	19:28845	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94016305	MF-424
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82955	19:27306	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94015090	MF-902; MF-940
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266	19:28846	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94016007	PC-423
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83316	19:27886	OSTI; NTIS; GPO Dep.	E 1.99:	DE94015020	MF-404
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79234	19:28919	OSTI; NTIS; GPO Dep.	E 1.99:	DE94016338	MF-405
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81937	19:28769	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94009685	MF-413
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189	19:28926	OSTI; NTIS; GPO Dep.	E 1.99:	DE94015816	MF-405
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77111	19:28920	OSTI; NTIS; GPO Dep.	E 1.99:	DE94016343	MF-405
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77610	19:28923	OSTI; NTIS; GPO Dep.	E 1.99:	DE94016344	MF-405
77652	19:28924	OSTI; NTIS; GPO Dep.	E 1.99:	DE94016341	MF-405
78200	19:28925	OSTI; NTIS; GPO Dep.	E 1.99:	DE94016369	MF-405
78203	19:28789	OSTI; NTIS; GPO Dep.	E 1.99:	DE94016374	MF-405
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83051	19:27920	OSTI; NTIS; GPO Dep.	E 1.99:	DE94015070	MF-404
83658	19:27940	OSTI; NTIS; GPO Dep.	E 1.99:	DE94016884	MF-404
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81187	19:27921	OSTI; NTIS; GPO Dep.	E 1.99:	DE94016901	MF-404
ANL/OTD-APS/CP–					
81858	19:28123	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94015022	MF-414
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7	19:28010	OSTI; NTIS; GPO Dep.	E 1.99:	DE94015011	MF-1406
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82290	19:28679	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94016337	MF-413
83297	19:28680	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94015093	MF-413
83448	19:28285	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94015078	MF-413
83505	19:28158	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94016314	MF-413
83522	19:28707	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94016330	MF-413
83538	19:28681	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94016351	MF-413
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83425	19:27530	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94015082	MF-533; MF-541

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79355	19:28045	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94014978	MF-506
79356	19:27766	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94014977	MF-506
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1	19:27683	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94014936	PC-940
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81425	19:28847	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94015068	MF-424
81660	19:28848	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94015085	MF-424
81967	19:28375	OSTI; NTIS; GPO Dep.	E 1.99:	DE94015081	
82060	19:28849	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94016311	MF-424
82096	19:28800	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94015095	MF-423
82097	19:28850	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94015025	MF-424
82182	19:27275	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94015065	MF-533
82770	19:28107	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94016350	
83100	19:27307	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94015062	MF-902
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82536	19:28774	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94016336	MF-411
82780	19:28159	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94016349	MF-411
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243	19:27449	OSTI; NTIS; GPO Dep.	E 1.99:	DE94015234	MF-502
2762	19:27308	OSTI; NTIS; GPO Dep.	E 1.99:	DE94015232	MF-502; MF-510
ARH-CD–					
371-4Q	19:27309	OSTI; NTIS; GPO Dep.	E 1.99:	DE94016661	MF-502
BMI–					
2164-Rev.1	19:27665	*See* NUREG/CR–5128-Rev.1			
BNL–					
49469	19:28511	OSTI; NTIS; GPO Dep.	E 1.99:	DE94009106	MF-403
49504	19:28275	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94015147	MF-414
49737	19:27324	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94016231	MF-603
49767	19:28108	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94015824	MF-414
49792	19:27887	OSTI; NTIS; GPO Dep.	E 1.99:	DE94015842	MF-404
49873	19:27469	OSTI; NTIS; GPO Dep.	E 1.99:	DE94015149	MF-901
49934	19:28708	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94015731	MF-413
49935	19:28709	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94015733	MF-414
49936	19:28710	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94015729	MF-414
49937	19:28711	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94015732	MF-414
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52381	19:28124	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94016578	MF-414
52415	19:28109	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94015839	MF-400
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60465	19:28160	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94016795	MF-414
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60544	19:28161	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94015847	MF-413
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49995	19:27767	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94015148	MF-520
52333-Vol.1	19:27677	*See* NUREG/CR–5908-Vol.1			
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52396	19:27775	*See* NUREG/CR–6128			
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52399-Vol.2-Pt.4	19:27649	*See* NUREG/CR–6144-Vol.2-Pt.4			
52399-Vol.2-Pt.5	19:27650	*See* NUREG/CR–6144-Vol.2-Pt.5			
52413	19:27496	*See* NUREG/CR–6212			
BNWL-CC–					
468	19:27679	OSTI; NTIS; GPO Dep.	E 1.99:	DE94016931	MF-500

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907	19:27268	OSTI; NTIS; GPO Dep.	E 1.99:	DE94015444	MF-500
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94-05	19:28574	OSTI; NTIS (US Sales Only); INIS		DE94786362	
BONN-IR–					
93-55	19:28288	OSTI; NTIS (US Sales Only); INIS		DE94786359	
93-67	19:28624	OSTI; NTIS (US Sales Only); INIS		DE94786360	
93-76	19:28625	OSTI; NTIS (US Sales Only); INIS		DE94786361	
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94-04	19:28598	OSTI; NTIS (US Sales Only); INIS		DE94789653	
94-05	19:28599	OSTI; NTIS (US Sales Only); INIS		DE94789655	
94-06	19:28600	OSTI; NTIS (US Sales Only); INIS		DE94789654	
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93-52	19:28626	OSTI; NTIS (US Sales Only); INIS		DE94633202	
93-59	19:28289	OSTI; NTIS (US Sales Only); INIS		DE94632786	
93-72	19:28165	OSTI; NTIS (US Sales Only); INIS		DE94632545	
93-80	19:28767	OSTI; NTIS (US Sales Only); INIS		DE94633368	
93-90	19:28277	OSTI; NTIS (US Sales Only); INIS		DE94632571	
BfS-ET–					
18/93	19:27310	OSTI; NTIS (US Sales Only); INIS		DE94789704	
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286.0-92	19:27636	OSTI; NTIS (US Sales Only); INIS		DE94632642	
287.4-92	19:27654	OSTI; NTIS (US Sales Only); INIS		DE94632740	
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11664	19:28548	OSTI; NTIS (US Sales Only); INIS		DE94632366	
11680	19:28290	OSTI; NTIS (US Sales Only); INIS		DE94632775	
11691	19:28627	OSTI; NTIS (US Sales Only); INIS		DE94633179	
11692	19:28682	OSTI; NTIS (US Sales Only); INIS		DE94633249	
11693	19:28584	OSTI; NTIS (US Sales Only); INIS		DE94633038	
11694	19:28530	OSTI; NTIS (US Sales Only); INIS		DE94632417	
11695	19:28699	OSTI; NTIS (US Sales Only); INIS		DE94633274	
11696	19:28790	OSTI; NTIS (US Sales Only); INIS		DE94633493	
11697	19:28166	OSTI; NTIS (US Sales Only); INIS		DE94632556	
11699	19:28683	OSTI; NTIS (US Sales Only); INIS		DE94633250	
11708	19:28715	OSTI; NTIS (US Sales Only); INIS		DE94633305	
11710	19:28716	OSTI; NTIS (US Sales Only); INIS		DE94633294	
11711	19:28628	OSTI; NTIS (US Sales Only); INIS		DE94633177	
11712	19:28717	OSTI; NTIS (US Sales Only); INIS		DE94633295	
11714	19:28684	OSTI; NTIS (US Sales Only); INIS		DE94633238	
11717	19:28549	OSTI; NTIS (US Sales Only); INIS		DE94632373	
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CEA-LNS-Ph–					
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93-06	19:28573	OSTI; NTIS (US Sales Only); INIS		DE94632964	
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00795	19:27661	OSTI; NTIS (US Sales Only); INIS		DE94632602	
CONF-781151–		(International meeting on advance fuel fabricators technology for research and test reactors; Argonne, IL (United States); 9-10 Nov 1978)			
	19:27683	*See* ANL/RERTR/TM–1			
CONF-910229–		(6. Lake Louise winter institute (LLWI-6): topical workshop on particle physics - the factory era; Lake Louise (Canada); 17-22 Feb 1991)			
	19:28747	*See* TRI-PP–91-4			
CONF-9103165–		(International conference on spin and isospin in nuclear interactions; Telluride, CO (United States); 11-15 Mar 1991)			
	19:28702	*See* TRI-PP–91-9			

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CONF-9103176–		(Workshop on future directions in nuclear physics with 4π gamma detection systems of the new generation; Strasbourg (France); 4-16 Mar 1991)			
	19:28291	*See* CENBG–9115			
CONF-9104312–		(Workshop on physics and detectors for DAPHNE; Frascati (Italy); 9-12 Apr 1991)			
	19:28119	*See* TRI-PP–91-7			
CONF-910505–		(1991 Institute of Electrical and Electronics Engineers (IEEE) particle accelerator conference (PAC); San Francisco, CA (United States); 6-11 May 1991)			
	19:28104	*See* TRI-PP–91-34			
	19:28105	*See* TRI-PP–91-41			
	19:28120	*See* TRI-PP–91-25			
	19:28121	*See* TRI-PP–91-29			
	19:28147	*See* TRI-PP–91-15			
	19:28148	*See* TRI-PP–91-16			
	19:28149	*See* TRI-PP–91-23			
	19:28247	*See* TRI-PP–91-17			
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	19:28259	*See* TRI-PP–91-32			
	19:28260	*See* TRI-PP–91-33			
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	19:28262	*See* TRI-PP–91-36			
	19:28263	*See* TRI-PP–91-37			
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	19:28265	*See* TRI-PP–91-39			
	19:28266	*See* TRI-PP–91-40			
	19:28267	*See* TRI-PP–91-42			
CONF-9105374–		(4. Blois international conference on elastic and diffractive scattering; Elba (Italy); 22-25 May 1991)			
	19:28615	*See* IPNO-TH–91-56			
	19:28651	*See* IPNO-TH–91-53			
CONF-9105429–		(7. Adriatic international conference on nuclear physics: heavy ion physics - today and tomorrow; Brijuni (Yugoslavia); 27 May - 1 jun 1991)			
	19:28718	*See* CRN-PN–91-11			
CONF-9106205–		(International symposium on structure and reactions of unstable nuclei; Niigata (Japan); 17-19 Jun 1991)			
	19:28692	*See* IPNO-DRE–91-28			
CONF-9106464–		(Workshop on neural networks from biology to high energy physics; Marciana Marina (Italy); 5-14 Jun 1991)			
	19:28657	*See* PCCF-RI–91-09			
CONF-9107134–		(7. annual coal preparation, utilization, and environmental control contractors conference; Pittsburgh, PA (United States); 15-18 Jul 1991)			
5	19:27192	OSTI; NTIS; GPO Dep.	E 1.99:	DE94014666	MF-102
CONF-9108129–		(North Atlantic Treaty Organization (NATO) ARW conference on complex dynamics and biological evolution; Middelfart (Denmark); 5-10 Aug 1991)			
	19:28726	*See* IPNO-DRE–91-37			
CONF-9108212–		(Symposium on nuclear physics; Tours (France); 29-31 Aug 1991)			
	19:28719	*See* CRN-PN–91-17			

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CONF-9108236–		(2. International conference on radioactive nuclear beams; Louvain-la-Neuve (Belgium); 19-21 Aug 1991)			
	19:28724	*See* IPNO-DRE–91-31			
CONF-910836–		(19. Stanford Linear Accelerator Center (SLAC) summer institute on particle physics; Stanford, CA (United States); 5-16 Aug 1991)			
	19:28620	*See* LPNHE–92-03			
CONF-9109127–		(Workshop on baryon spectroscopy and the structure of the nucleon; Saclay (France); 23-25 Sep 1991)			
	19:28650	*See* IPNO-DRE–91-36			
	19:28727	*See* IPNO-DRE–92-02			
CONF-9109182–		(2. international workshop on theoretical and phenomenological aspects of underground physics; Toledo (Spain); 9-13 Sep 1991)			
	19:28292	*See* CENBG–9116			
CONF-9109453–		(13. European conference on few-body problems in physics; Elba (Italy); 9-14 Sep 1991)			
	19:28616	*See* IPNO-TH–91-75			
CONF-9109543–		(Conference 'Hadron structure 91'; Stara-Lesna (Czech Republic); 16-19 Sep 1991)			
	19:28725	*See* IPNO-DRE–91-34			
CONF-9112111–		(KEK workshop on rare kaon decay physics; Tsukuba (Japan); 10-11 Dec 1991)			
	19:28122	*See* TRI-PP–92-13			
CONF-9112183–		(2. International workshop on nuclear theory and related topics; Hanoi (Viet Nam); 2-9 Dec 1991)			
	19:28673	*See* IPNO-TH–92-22			
CONF-920126–		(13. international conference on few body problems in physics; Adelaide (Australia); 5-11 Jan 1992)			
	19:28652	*See* IPNO-TH–91-97			
CONF-9203281–		(Nuclear structure models workshop; Oak Ridge, TN (United States); 16-25 Mar 1992)			
	19:28683	*See* CEA-CONF–11699			
CONF-920362–		(9. topical conference on high-temperature plasma diagnostics; Santa Fe, NM (United States); 15-19 Mar 1992)			
49	19:28801	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94016297	MF-420
CONF-9205407–		(International symposium on topics in microbial diversity, metabolism, and physiology; Urbana, IL (United States); 22-23 May 1992)			
Absts.	19:28536	OSTI; NTIS; GPO Dep.	E 1.99:	DE94013178	MF-408
CONF-9206451–		(Ultrafast phenomena; Antibes-Juan-les-Pins (France); 8-12 Jun 1992)			
	19:28166	*See* CEA-CONF–11697			
CONF-9206452–		(Expert discussion on problems of radionuclide migration and long-term safety of the projected ultimate storage site at Gorleben; Salzgitter (Germany); 3 Jun 1992)			
	19:27310	*See* BfS-ET–18/93			
CONF-9207241–		(Conference on nonlinear evolution equations and dynamical systems; Dubna (Russian Federation); 6-17 Jul 1992)			
	19:28790	*See* CEA-CONF–11696			
CONF-920804–		(28. national heat transfer conference; San Diego, CA (United States); 9-12 Aug 1992)			
28	19:28045	*See* ANL/RE/CP–79355			
CONF-9208190–		(27. Zakopane School of Physics conference; Zakopane (Poland); 31 Aug - 3 sep 1992)			
	19:28699	*See* CEA-CONF–11695			
CONF-9209320–		(International workshop on chromosome 12; Oxford (United Kingdom); 18-20 Sep 1992)			
1	19:28529	*See* DOE/ER/61502–1			
CONF-920933–		(16. world conference of the International Nuclear Target Development Society: nuclear target preparation; Legnaro (Italy); 21-25 Sep 1992)			
	19:28217	*See* GSI–93-36(prepr.)			

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CONF-9209342–		(International conference on nuclear structure and nuclear reactions at low and intermediate energies; Dubna (Russian Federation); 15-19 Sep 1992)			
	19:28698	*See* JINR-E–4-93-58			
CONF-9209425–		(International Working Group on Nuclear Power Plant Control and Instrumentation; Chalk River (Canada); 8-11 Sep 1992)			
	19:27670	*See* AECL–10777			
CONF-9210249–		(1992 international symposium on rapidly rotating nuclei; Tokyo (Japan); 26-30 Oct 1992)			
	19:28682	*See* CEA-CONF–11692			
CONF-9210470–		(VBC'92: Visualization in biomedical computing; Chapel Hill (United States); 13-16 Oct 1992)			
	19:28530	*See* CEA-CONF–11694			
CONF-9210471–		(International school of physics Enrico Fermi 'Nuclear magnetic double resonance'; Varenna (Italy); 13-21 Oct 1992)			
	19:28584	*See* CEA-CONF–11693			
CONF-9210474–		(ECFA: Workshop on a B-meson factory; Hamburg (Germany); Oct 1992)			
	19:28601	*See* CERN-TH–6841-93			
CONF-921110–		(Winter annual meeting of the American Society of Mechanical Engineers (ASME); Anaheim, CA (United States); 8-13 Nov 1992)			
54	19:27766	*See* ANL/RE/CP–79356			
CONF-921131–		(10. international symposium on high-energy spin physics; Nagoya (Japan); 9-14 Nov 1992)			
	19:28167	*See* CEA-LNS-Ph–93-15			
	19:28629	*See* CEA-LNS-Ph–93-14			
CONF-921203–		(Thermal performance of the exterior envelopes of buildings; Clearwater, FL (United States); 7-10 Dec 1992)			
13	19:27839	*See* LBL–33192			
CONF-930173–		(HIPAGS 93: workshop on heavy ion physics at the alternating gradient synchrotron; Cambridge, MA (United States); 14-17 Jan 1993)			
22	19:28712	*See* BNL–49943			
CONF-930187–		(13. Moriond workshop on perspectives in neutrinos, atomic physics, and gravitation; Villars-sur-Ollon (Switzerland); 30 Jan - 6 feb 1993)			
	19:28627	*See* CEA-CONF–11691			
CONF-930304–		(205. American Chemical Society national meeting; Denver, CO (United States); 28 Mar - 2 apr 1993)			
33	19:27936	*See* SAND–94-1669C			
CONF-9303228–		(Workshop on HERA: the new frontier for QCD; Durham (United Kingdom); 21-26 Mar 1993)			
	19:28655	*See* LPNHE–93-07			
CONF-9303281–		(American Institute of Chemical Engineers (AICHE) conference; Chicago, IL (United States); Mar 1993)			
1	19:27963	OSTI; NTIS; GPO Dep.	E 1.99:	DE94013112	MF-246
CONF-930405–		(Spring meeting of the Materials Research Society; San Francisco, CA (United States); 12-16 Apr 1993)			
56	19:27930	*See* LBL–35660			
CONF-9305235–		(International workshop/time reversal invariance and parity violation in neutron physics; Dubna (Russian Federation); 4-7 May 1993)			
	19:28715	*See* CEA-CONF–11708			
CONF-9305241–		(6. international workshop on perspectives in intermediate energy nuclear physics; Trieste (Italy); 4-7 May 1993)			
5	19:28720	*See* DOE/ER/40270–53			
CONF-9305339–		(Technology and science at a high-power spallation source workshop; Argonne, IL (United States); 13-16 May 1993)			
	19:28769	*See* ANL/IPNS/PROC–81937			

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CONF-9305364–		(23. International meeting on the physics of charged particle interaction with crystals; Moscow (Russian Federation); 31 May - 2 jun 1993)			
	19:28779	*See* INIS-RU–377			
CONF-9306134–		(Conference on hadron; Como (Italy); 21-25 Jun 1993)			
	19:28674	*See* LAL–93-60			
CONF-9306354–		(9. nonlinear finite element analysis and ADINA conference; Boston, MA (United States); 23-25 Jun 1993)			
1	19:27902	*See* KAPL–4782			
CONF-930636–		(10. international conference on ultra-relativistic nucleus-nucleus collisions; Borlaenge (Sweden); 20-24 Jun 1993)			
14	19:28709	*See* BNL–49935			
15	19:28708	*See* BNL–49934			
16	19:28711	*See* BNL–49937			
CONF-930637–		(13. international conference on particles and nuclei; Perugia (Italy); 27 Jun - 3 jul 1993)			
	19:28716	*See* CEA-CONF–11710			
CONF-9307145–		(Workshop on electron nucleus scattering; Elba (Italy); 5-10 Jul 1993)			
	19:28628	*See* CEA-CONF–11711			
CONF-9307191–		(S-band linear collider meeting; Hamburg (Germany); 7-8 Jul 1993)			
	19:28242	*See* LAL-RT–93-14			
CONF-930761–		(International Europhysics conference on high-energy physics; Marseille (France); 22-28 Jul 1993)			
	19:28618	*See* LAL–93-64			
	19:28717	*See* CEA-CONF–11712			
CONF-9308111–		(3. international conference of the International Building Performance Simulation Association; Adelaide (Australia); 16-18 Aug 1993)			
2	19:27840	*See* LBL–33906			
CONF-930816–		(International conference on the applications of the Moessbauer effect; Vancouver (Canada); 8-14 Aug 1993)			
	19:28775	*See* KFKI–1993-20/E			
CONF-9308164–		(14. European conference on few-body problems in physics; Amsterdam (Netherlands); 22-27 Aug 1993)			
	19:28684	*See* CEA-CONF–11714			
	19:28685	*See* CEA-DAPNIA-SPhN–93-46			
CONF-9308199–		(23. Mazurian Lakes summer school on nuclear physics: Frontier topics in nuclear, astronuclear and astroparticle physics; Piaski (Poland); 18-28 Aug 1993)			
	19:28704	*See* GANIL-P–93-31			
CONF-9308209–		(Conference on disarmament and arms limitation obligations: problems of compliance and enforcement; Geneva (Switzerland); 5-6 Aug 1993)			
	19:28573	*See* CERN–93-06			
CONF-930851–		(9. American conference on crystal growth: crystal growth, characterization and applications; Baltimore, MD (United States); 1-6 Aug 1993)			
3	19:27949	*See* KAPL–4777			
CONF-930867–		(Gull Lake nuclear physics conference on giant resonances; Gull Lake, MI (United States); 17-21 Aug 1993)			
5	19:28710	*See* BNL–49936			
CONF-9309170–		(5. international workshop on targetry and target chemistry; Upton, NY (United States); 20-24 Sep 1993)			
4	19:28001	*See* BNL–60338			
CONF-9309176–		(2. international conference on computational physics; Beijing (China); 13-17 Sep 1993)			
1-Rev.1	19:28761	*See* UCRL-JC–114326-Rev.1			

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
CONF-9309228–		(Focus 93: site characterization and model validation; Las Vegas, NV (United States); 26-29 Sep 1993)			
11	19:27326	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94014850	MF-814
CONF-930926–		(13. international conference on magnet technology; Victoria (Canada); 20-24 Sep 1993)			
39	19:28275	*See* BNL–49504			
CONF-9309395–		(5. European conference on the science of life in space; Arcachon (France); 26 Sep - 1 oct 1993)			
	19:28549	*See* CEA-CONF–11717			
CONF-9309396–		(Hadron structure '93 conference; Banska Stiavnica (Slovakia); Sep 1993)			
	19:28654	*See* LAL–93-66			
CONF-930999–		(NATO Advanced Study Institute on hot and dense nuclear matter; Bodrum (Turkey); 26 Sep - 9 oct 1993)			
	19:28737	*See* LPN–93-18			
CONF-9310102–		(4. energy natural phenomena hazards mitigation conference; Atlanta, GA (United States); 19-22 Oct 1993)			
46	19:27415	*See* WHC-SA–2016			
CONF-9310261–		(SCIFI 93: workshop on scintillating fiber detectors; South Bend, IN (United States); 24-28 Oct 1993)			
	19:28294	*See* DESY–93-199			
	19:28295	*See* DESY–93-200			
CONF-9310276–		(8. wildland shrub and arid land restoration symposium; Las Vegas, NV (United States); 19-21 Oct 1993)			
Summ.	19:28489	*See* EGG–11265-2022			
CONF-9310279–		(Three days on gamma and x-rays spectrometry; Saint-Remy-les-Chevreuse (France); 12-14 Oct 1993)			
	19:28290	*See* CEA-CONF–11680			
CONF-9310285–		(Institute of Electrical and Electronic Engineers-Industry Applications Society (IEEE-IAS) annual meeting; Ontario (Canada); 2-8 Oct 1993)			
2	19:27844	*See* LBL–35253			
3	19:27845	*See* LBL–35256			
CONF-9310298–		(International workshop on radioactive nuclear beams produced by fragment-separation techniques; Varna (Bulgaria); 12-15 Oct 1993)			
	19:28141	*See* GANIL-P–94-03			
CONF-9310319–		(International school on paradigms in nuclear physics; Erice (Italy); 10-15 Oct 1993)			
	19:28687	*See* GANIL-P–93-30			
CONF-9310335–		(International conference on 'Harmonization in radiation protection: from theory to practical applications'; Taormina (Italy); 11-13 Oct 1993)			
	19:28548	*See* CEA-CONF–11664			
CONF-9310340–		(Workshop on nuclear fusion and plasma physics; Hefei (China); 4-15 Oct 1993)			
1	19:28822	*See* GA-A–21466			
CONF-931048–		(11. international workshop on laser interaction and related plasma phenomena; Monterey, CA (United States); 25-29 Oct 1993)			
15	19:28844	*See* UCRL-JC–116212			
CONF-931063–		(International symposium on remediation and restoration of radioactive-contaminated sites in Europe; Antwerp (Belgium); 11-15 Oct 1993)			
1	19:28475	*See* UCRL-JC–115076			
CONF-931095–		(Department of Energy environmental remediation conference; Augusta, GA (United States); 24-28 Oct 1993)			
39-Rev.2	19:28504	*See* UCRL-JC–113790-Rev.2			

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CONF-9311147–		(IAEA meeting on H-mode physics; Naka (Japan); 15-17 Nov 1993)			
9	19:28823	*See* GA-A–21523			
CONF-9311224–		(12. international conference on thermoelectrics; Yokohama (Japan); 9-11 Nov 1993)			
1	19:27901	*See* KAPL–4766			
CONF-9311226–		(2. workshop on TRISTAN physics at high luminosities; Tsukuba (Japan); 24-26 Nov 1993)			
	19:28653	*See* KEK-PROC–93-22			
CONF-931160–		(American Nuclear Society (ANS) winter meeting; San Francisco, CA (United States); 14-18 Nov 1993)			
45	19:27373	*See* LA-UR–94-2019			
CONF-940104–		(Winter meeting of the American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE); New Orleans, LA (United States); 22-26 Jan 1994)			
8	19:27841	*See* LBL–34271			
9	19:27842	*See* LBL–34715			
10	19:27843	*See* LBL–34717			
CONF-940142–		(OE/LASE '94: conference on optics, electro-optics, and laser applications in science and engineering; Los Angeles, CA (United States); 22-29 Jan 1994)			
42	19:28096	*See* UCRL-JC–114954			
CONF-940178–		(2. international conference on on-site analysis and field-portable instrumentation; Houston, TX (United States); 24-26 Jan 1994)			
2	19:28506	*See* WHC-SA–2284			
CONF-940191–		(Northwest Alfalfa Seed Growers conference; Reno, NV (United States); 31 Jan - 1 feb 1994)			
1	19:28567	*See* PNL-SA–23736			
CONF-940192–		(32. international meeting on nuclear physics; Bormio (Italy); 24-29 Jan 1994)			
	19:28218	*See* GSI–94-24(prepr.)			
CONF-940194–		(4. annual Advanced Research Project Agency (ARPA) symposium on photonics systems for antenna applications; Monterey, CA (United States); 18-21 Jan 1994)			
1-Rev.1	19:28099	*See* UCRL-JC–115712-Rev.1			
CONF-940212–		(Seminar on developments in radioactive waste transport; Vienna (Austria); 21-25 Feb 1994)			
1	19:27279	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94009176	MF-902
CONF-940222–		(Corrosion 94: National Association of Corrosion Engineers (NACE) international annual conference; Baltimore, MD (United States); 28 Feb - 4 mar 1994)			
17	19:27900	*See* KAPL–4763			
CONF-940225–		(Waste management '94; Tucson, AZ (United States); 27 Feb - 3 mar 1994)			
117	19:27359	*See* FEMP–2324			
118	19:27489	*See* FEMP–2303			
119	19:27492	*See* FEMP–2322			
CONF-940226–		(9. advanced solid-state lasers meeting; Salt Lake City, UT (United States); 7-10 Feb 1994)			
8	19:28097	*See* UCRL-JC–115149			
CONF-940268–		(21. Japan conference on radiation and radioisotopes; Tokyo (Japan); 2-4 Feb 1994)			
	19:28891	*See* INIS-JP–024			
CONF-940278–		(HTS wire development workshop; St. Petersburg, FL (United States); 16-17 Feb 1994)			
	19:28791	OSTI; NTIS; GPO Dep.	E 1.99:	DE94015650	MF-1392
CONF-940288–		(2. IFT workshop on Yukawa couplings and the origin of mass; Gainesville, FL (United States); 11-13 Feb 1994)			
1	19:28619	*See* LBL–35530			

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CONF-940291–		(Society of Petroleum Engineers (SPE) formation damage control symposium; Lafayette, LA (United States); 7-10 Feb 1994)			
1	19:27259	*See* DOE/METC/C–94/7126			
CONF-940301–		(207. spring national meeting of the American Chemical Society (ACS); San Diego, CA (United States); 13-18 Mar 1994)			
36	19:28531	OSTI; NTIS; GPO Dep.	E 1.99:	DE94013261	MF-407
CONF-940312–		(2. Probabilistic safety assessment and management conference (PSAM); San Diego, CA (United States); 20-24 Mar 1994)			
59	19:27778	*See* PNL-SA–22426			
62	19:28970	*See* UCRL-JC–115069			
CONF-9403131–		(International conference on nuclear structure in the late nineties; Hanoi (Viet Nam); 14-18 Mar 1994)			
2	19:28593	*See* LBL–35525			
CONF-9403138–		(Automotive laser applications workshop; Dearborn, MI (United States); 7-8 Mar 1994)			
1	19:27866	*See* UCRL-JC–116773			
CONF-9403139–		(Workshop on harmonic oscillators; Cocoyoc (Mexico); 23-25 Mar 1994)			
1	19:28579	*See* LA-UR–94-1949			
CONF-9403142–		(International PCG symposium on matrix analysis and parallel computing; Yokohama (Japan); 15-16 Mar 1994)			
1	19:28937	*See* LA-UR–94-1602			
CONF-9403143–		(Solar modeling workshop: Seattle, WA (United States); 21-24 Mar 1994)			
1	19:28586	*See* LA-UR–94-1587			
CONF-9403144–		(6. international symposium on advanced nuclear energy research; Mito (Japan); 23-25 Mar 1994)			
1	19:28098	*See* UCRL-JC–115511			
CONF-940320–		(Coal utilization and fuel systems: the greening of coal; Clearwater, FL (United States); 21-24 Mar 1994)			
1	19:27633	OSTI; NTIS; GPO Dep.	E 1.99:	DE94014849	MF-113
CONF-940327–		(29. Moriond meeting on quantum chromodynamics and high energy hadronic interactions; Les Arcs (France); 12-26 Mar 1994)			
7	19:28647	*See* FNAL/C–94/180-E			
CONF-940391–		(Society of Photo-Optical Instrumentation Engineers (SPIE) conference; Kona Beach, HI (United States); 13-18 Mar 1994)			
10	19:28595	*See* UCRL-JC–114938			
CONF-940392–		(Cray User's meeting; San Diego, CA (United States); 14-18 Mar 1994)			
2	19:28953	*See* UCRL-JC–116227			
CONF-940397–		(Wester States section of the Combustion Institute spring meeting; Davis, CA (United States); 21-22 Mar 1994)			
5	19:27239	*See* SAND–94-8652C			
CONF-940399–		(Life prediction methodology for titanium matrix composites symposium; Hilton Head, SC (United States); 22-24 Mar 1994)			
1	19:27943	OSTI; NTIS; GPO Dep.	E 1.99:	DE94016000	MF-404
CONF-940401–		(International conference on methods and applications of radioanalytical chemistry; Kona, HI (United States); 10-16 Apr 1994)			
16	19:28499	*See* PNL-SA–23148			
CONF-940405–		(International symposium on decontamination and decommissioning; Knoxville, TN (United States); 27-29 Apr 1994)			
14	19:27494	*See* FEMP–2330			
CONF-940407–		(Topical meeting on advances in reactor physics; Knoxville, TN (United States); 11-14 Apr 1994)			
22	19:27767	*See* BNL-NUREG–49995			

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CONF-9404100–		(Symposium on the non-proliferation experiment results and implications for test ban treaties; Rockville, MD (United States); 19-21 Apr 1994)			
8	19:28397	*See* UCRL-JC–116428			
10	19:28396	*See* PNL-SA–23966			
CONF-9404102–		(12. geothermal program review: geothermal's role in global climate change - impacts on the Climate Change Action Plan; San Francisco, CA (United States); 25-28 Apr 1994)			
6	19:27620	*See* LA-UR–94-1606			
CONF-940411–		(Spring meeting of the Materials Research Society; San Francisco, CA (United States); 4-8 Apr 1994)			
41	19:27952	*See* LBL–35626			
42	19:28331	*See* LBL–35435			
43	19:28343	*See* BNL–60593			
44	19:27957	*See* SAND–94-1726C			
46	19:27953	*See* SAND–93-2758C			
48	19:27951	*See* LBL–34810			
CONF-9404150–		(Specialist's meeting on shielding aspects of accelerators, targets and irradiation facilities; Arlington, TX (United States); 28-29 Apr 1994)			
2	19:28243	*See* LBL–35459			
CONF-940416–		(96. annual meeting of the American Ceramic Society; Indianapolis, IN (United States); 24-28 Apr 1994)			
17	19:27390	*See* PNL-SA–23488			
20	19:27934	*See* SAND–94-1305C			
21	19:27387	*See* PNL-SA–23384			
22	19:27389	*See* PNL-SA–23487			
23	19:27388	*See* PNL-SA–23454			
CONF-9404162–		(1994 caliope interim technical review; Oakland, CA (United States); 26-28 Apr 1994)			
9	19:28085	*See* SAND–94-1436C			
CONF-9404166–		(Conference on alternatives for pollution control from coal-fired low emission sources; Plzen (Czech Republic); 26-28 Apr 1994)			
	19:27219	OSTI; NTIS; GPO Dep.	E 1.99:	DE94015592	MF-105
CONF-9404167–		(SPIE 13: international symposium on optical materials technology for energy efficiency and solar energy conversion; Freiburg (Germany); 18-22 Apr 1994)			
1-Rev.	19:27846	*See* LBL–35382-Rev.			
CONF-9404182–		(3. intermetallic matrix composites; San Francisco, CA (United States); 4-6 Apr 1994)			
1	19:27960	*See* UCRL-JC–116440			
CONF-9404183–		(NABMAG 2: North American Biiomagnetism Action Group conference; Detroit, MI (United States); 15-17 Apr 1994)			
1	19:28532	*See* LA-UR–94-1446			
CONF-9404184–		(LAMPF user's group meeting; Washington, DC (United States); 20 Apr 1994)			
1	19:27371	*See* LA-UR–94-1429			
CONF-9404185–		(4. IEEE workshop on software engineering technology transfer; Dallas, TX (United States); 28-29 Apr 1994)			
1	19:27815	*See* UCRL-JC–115839			
CONF-9404186–		(Tank waste chemical reactions meeting; Richland, WA (United States); 11 Apr 1994)			
1	19:27391	*See* PNL-SA–24065			
CONF-9404188–		(Joint USDA/DOE meeting; Beltsville, MD (United States); 11-12 Apr 1994)			
	19:28538	OSTI; NTIS; GPO Dep.	E 1.99:	DE94014983	MF-1400
CONF-9404189–		(Materials Research Society (MRS) meeting; Pittsburgh, PA (United States); Apr 1994)			
1	19:28794	*See* LA-UR–94-1614			

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CONF-9404190–		(International symposium on electroanalysis; Cardiff (United Kingdom); 6-8 Apr 1994)			
1	19:27984	*See* PNL-SA–23945			
CONF-9404191–		(Atlas week conference; Geneva (Switzerland); 18-22 Apr 1994)			
1	19:28284	*See* ANL-HEP-TR–94-28			
CONF-9404192–		(Sigma Xi forum for scientists educators and national standards on action at the local level; Atlanta, GA (United States); 14-15 Apr 1994)			
1	19:27804	*See* SAND–94-1518C			
CONF-940492–		(Meeting on computing in high-energy physics; San Francisco, CA (United States); 21-27 Apr 1994)			
9	19:28964	*See* ANL-HEP-CP–94-38			
10	19:28963	*See* ANL-HEP-CP–94-37			
CONF-940494–		(International workshop on superconductivity and particle detection; Toledo (Spain); 20-24 Apr 1994)			
1	19:28338	*See* PNL-SA–24509			
CONF-940495–		(Federal environmental restoration and waste minimization conference and exhibition; New Orleans, LA (United States); 25-29 Apr 1994)			
12	19:27462	*See* WHC-SA–2278			
CONF-940507–		(International conference on nuclear data for science and technology; Gatlinburg, TN (United States); 9-13 May 1994)			
25	19:28589	*See* LA-UR–94-1616			
26	19:28732	*See* LA-UR–94-1592			
27	19:28326	*See* LA-UR–94-1591			
29	19:28733	*See* LA-UR–94-1594			
30	19:28731	*See* LA-UR–94-1581			
32	19:28759	*See* UCRL-JC–117464			
33	19:28751	*See* UCRL-JC–117468			
34	19:28750	*See* UCRL-JC–117462			
35	19:28749	*See* UCRL-JC–117461			
CONF-9405109–		(Department of Energy defense programs packaging workshop; Knoxville, TN (United States); 16-19 May 1994)			
6	19:28006	OSTI; NTIS; GPO Dep.	E 1.99:	DE94011461	MF-721
CONF-9405122–		(DOE predictive maintenance technology symposium; Atlanta, GA (United States); 16-18 May 1994)			
2	19:27514	*See* WHC-SA–2388			
CONF-9405126–		(EG&G GOCO environmental conference; Las Vegas, NV (United States); 10-12 May 1994)			
1	19:28945	*See* RFP–4728			
CONF-9405132–		(14. international conference on few body problems in physics; Williamsburg, VA (United States); 26-31 May 1994)			
6	19:28613	*See* DOE/ER/40561–147			
7	19:28675	*See* LA-UR–94-2327			
CONF-9405136–		(1994 joint USA-Russia energetic material technology symposium; Livermore, CA (United States); 18-25 May 1994)			
14	19:28380	*See* SAND–94-8616C			
CONF-9405137–		(NEA/OECD/NSC specialists meeting on intermediate energy nuclear data (IEND) codes; Paris (France); 30 May - 1 jun 1994)			
5	19:28713	*See* BNL–60505			
CONF-9405139–		(1994 international American Vacuum Society users conference; Boston, MA (United States); 2-13 May 1994)			
3	19:28366	*See* UCRL-JC–117434			
CONF-940514–		(Intersections of particle and nuclear physics; St. Petersburg, FL (United States); 31 May - 6 jun 1994)			
5	19:28714	*See* BNL–60633			
6	19:28158	*See* ANL/PHY/CP–83505			
7	19:28735	*See* LA-UR–94-2420			
8	19:28707	*See* ANL/PHY/CP–83522			
9	19:28623	*See* ANL-HEP-CP–94-40			

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CONF-9405144–		(Nuclear criticality technology safety project workshop; Williamsburg, VA (United States); 10-11 May 1994)			
2	19:27372	*See* LA-UR–94-1461			
CONF-9405145–		(1994 American Filtration and Separation Society national meeting; Chicago, IL (United States); 9-11 May 1994)			
1	19:27635	*See* WSRC-MS–94-0130			
CONF-9405159–		(Unexploded ordnance detection and range-remediation conference; Golden, CO (United States); 17-19 May 1994)			
3	19:28374	*See* UCRL-JC–117191			
CONF-9405168–		(6. Pisa meeting on advanced detectors; Elba (Italy); 22-28 May 1994)			
3	19:28303	*See* FNAL-TM–1895			
4	19:28300	*See* FNAL/C–94/183			
CONF-9405170–		(10. international conference on positron annihilation; Beijing (China); 23-29 May 1994)			
6	19:27941	*See* BNL–60538			
CONF-9405188–		(Organization for Economic Co-Oeration and Development conference meeting on intermediate energy nuclear data; Issy-les-Moulineaux (France); 30 May - 1 jun 1994)			
1	19:28734	*See* LA-UR–94-1907			
CONF-9405189–		(Wetlands: local functions, global dependence conference; Portland, OR (United States); 30 May - 2 jun 1994)			
1	19:27591	*See* PNL-SA–24329			
CONF-9405190–		(LIGNIN workshop on research needs in LIGNIN biosynthesis and biodegradation; Pacific Grove, CA (United States); 25-26 May 1994)			
1	19:28528	*See* PNL-SA–24337			
CONF-9405192–		(Nuclear facility PdM symposium; Atlanta, GA (United States); 16 May - 18 jun 1994)			
1	19:28037	*See* PNL-SA–23990			
CONF-9405197–		(Electro @/94 international conference; Boston, MA (United States); 10-12 May 1994)			
1	19:28500	*See* PNL-SA–24175			
CONF-9405198–		(6. international workshop on slow-positron beam techniques for solids and surfaces (SLO-POS6); Makuhari (Japan); 18-22 May 1994)			
1	19:27942	*See* BNL–60588			
3	19:28778	*See* BNL–60605			
CONF-9405199–		(LeCroy conference on electronics for future colliders; Montvale, NJ (United States); 10-11 May 1994)			
1	19:28285	*See* ANL/PHY/CP–83448			
CONF-9405200–		(DIMACS workshop on the specification of parallel algorithms; Princeton, NJ (United States); 9-11 May 1994)			
1	19:28958	*See* UCRL-JC–116641			
CONF-940524–		(8. symposium on radiation measurements and applications; Ann Arbor, MI (United States); 16-19 May 1994)			
11	19:27468	*See* WSRC-MS–94-065(P)			
12	19:28299	*See* FNAL/C–94/140			
13	19:28337	*See* PNL-SA–24272			
CONF-940528–		(Incineration conference: 13th international symposium on thermal treatment technologies; Houston, TX (United States); 9-13 May 1994)			
5	19:28473	*See* SAND–94-8653C			
CONF-940529–		(185. Electrochemical Society meeting; San Francisco, CA (United States); 22-27 May 1994)			
18	19:27887	*See* BNL–49792			
19	19:27883	*See* LA-UR–94-2385			
20	19:27938	*See* UCRL-JC–117504			
21	19:28786	*See* LA-UR–94-2388			

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
CONF-940531–		(International symposium on electromagnetic environments and consequences; Bordeaux (France); 30 May - 3 jun 1994)			
2	19:28269	*See* ANL/APS/CP–83263			
CONF-940548–		(American Wind Energy Association annual conference and exhibition; Minneapolis, MN (United States); 9-13 May 1994)			
5	19:27625	*See* NREL/TP–440-6628			
6	19:27627	*See* NREL/TP–441-7044			
CONF-940552–		(10. topical conference on high-temperature plasma diagnostics; Rochester, NY (United States); 8-12 May 1994)			
	19:28819	*See* DOE/ER/54241–131			
15	19:28832	*See* LA-UR–94-1605			
18	19:28880	*See* UCRL-JC–115599			
CONF-940553–		(International high-level radioactive waste management conference; Las Vegas, NV (United States); 22-26 May 1994)			
16	19:27394	*See* SAND–94-0482C			
19	19:27506	*See* SAND–94-0764C			
22	19:27403	*See* UCRL-JC–114776			
40	19:27327	OSTI; NTIS; GPO Dep.	E 1.99:	DE94010122	MF-940
70	19:27386	*See* PNL-SA–23186			
74	19:27404	*See* UCRL-JC–116350			
79	19:27377	*See* LBL–35909			
CONF-940554–		(8. high temperature materials conference; Vienna (Austria); 5-8 May 1994)			
1	19:28102	*See* UCRL-JC–116823			
CONF-940578–		(Pollution prevention conference; Denver, CO (United States); 3-5 May 1994)			
10	19:27392	*See* PNL-SA–24210			
Summ.	19:28969	*See* PNL-SA–23679			
CONF-940580–		(11. international conference on plasma surface interactions in controlled fusion devices; Mito (Japan); 23-27 May 1994)			
5	19:28877	*See* PPPL-CFP–3091			
6	19:28843	*See* SAND–94-1874C			
7	19:28851	*See* DOE/ER/53198–242			
8	19:28864	*See* GA-A–21679			
10	19:28865	*See* GA-A–21705			
12	19:28871	*See* LA-UR–94-2268			
CONF-940592–		(4. international colloquium on X-ray lasers; Williamsburg, VA (United States); 16-20 May 1994)			
1	19:28103	*See* UCRL-JC–117488			
CONF-940602–		(35. annual meeting of the American Nuclear Society; New Orleans, LA (United States); 11-16 Jun 1994)			
12	19:27493	*See* FEMP–2328			
13	19:27491	*See* FEMP–2318			
15	19:27915	*See* WHC-SA–2261			
CONF-9406105–		(1994 American Society of Heating, Refrigerating, and Air Conditioning Engineers (ASHRAE) summer meeting; Orlando, FL (United States); 25-29 Jun 1994)			
2	19:27851	*See* PNL-SA–23225			
CONF-9406107–		(1994 Health Physics Society (HPS) summer school on internal dosimetry; Davis, CA (United States); 6 Jun 1994)			
3	19:28561	*See* PNL-SA–24192			
4	19:28560	*See* PNL-SA–24153			
CONF-940614–		(85. annual conference of the International District Heating and Cooling Association and trade show; Seattle, WA (United States); 18-22 Jun 1994)			
1	19:27875	*See* PNL-SA–24197			
CONF-9406143–		(1. international conference on advanced oxidation technologies for water and air remediation; London (Canada); 25-30 Jun 1994)			
1	19:28469	*See* PNL-SA–24432			

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
CONF-940615–		(15. international cryogenic engineering conference; Genoa (Italy); 7-10 Jun 1994)			
1	19:28276	*See* BNL–60555			
CONF-940616–		(Electronic materials conference; Boulder, CO (United States); 22-24 Jun 1994)			
1	19:27954	*See* SAND–94-0506C			
CONF-9406161–		(Safety analysis working group workshop; Albuquerque, NM (United States); 8-10 Jun 1994)			
1	19:27504	*See* RFP–4848			
CONF-9406171–		(3. international workshop on ceramic breeder blanket interactions; Los Angeles, CA (United States); 22-24 Jun 1994)			
2	19:28875	*See* PNL-SA–24433			
CONF-940618–		(4. European particle accelerator conference; London (United Kingdom); 27 Jun - 1 jul 1994)			
9	19:28163	*See* BNL–60586			
10	19:28106	*See* ANL/ASD/CP–81625			
12	19:28123	*See* ANL/OTD-APS/CP–81858			
13	19:28273	*See* ANL/ASD/CP–83408			
14	19:28272	*See* ANL/ASD/CP–83387			
15	19:28153	*See* ANL/ASD/CP–83412			
17	19:28274	*See* ANL/ASD/CP–83409			
18	19:28113	*See* FNAL/C–94/181			
19	19:28108	*See* BNL–49767			
20	19:28140	*See* FNAL/C–94/191			
21	19:28114	*See* FNAL/C–94/192			
22	19:28162	*See* BNL–60554			
25	19:28271	*See* ANL/ASD/CP–81727			
26	19:28270	*See* ANL/ASD/CP–81725			
27	19:28151	*See* ANL/ASD/CP–81728			
28	19:28152	*See* ANL/ASD/CP–81729			
29	19:28156	*See* ANL/ASD/CP–83555			
30	19:28116	*See* LA-UR–94-2439			
31	19:28154	*See* ANL/ASD/CP–83489			
32	19:28155	*See* ANL/ASD/CP–83492			
33	19:28157	*See* ANL/ASD/CP–83663			
CONF-9406180–		(6. international symposium on electron beam ion sources and their applications; Stockholm (Sweden); 20-23 Jun 1994)			
3	19:28161	*See* BNL–60544			
CONF-9406181–		(Joint Army, Navy, NASA, Air Force environmentally benign cleaning and degreasing technical workshop; Indian Head, MD (United States); 14-15 Jun 1994)			
3	19:27864	*See* PNL-SA–24365			
CONF-9406192–		(8. international symposium on solar terrestrial physics; Sendai (Japan); 6-10 Jun 1994)			
2	19:28588	*See* LA-UR–94-1610			
3	19:28590	*See* LA-UR–94-2129			
CONF-9406196–		(7. multinational TMD conference; Annapollis, MD (United States); 21-24 Jun 1994)			
1-VUGRAPHS	19:28378	*See* LA-UR–94-1434			
CONF-9406197–		(American Nuclear Society meeting; La Grange Park, IL (United States); 19-24 Jun 1994)			
1	19:28870	*See* LA-UR–94-2107			
CONF-9406200–		(7. international conference on nuclear reaction mechanisms; Vaienna (Italy); 6-11 Jun 1994)			
2	19:28706	*See* UCRL-JC–117466			
CONF-9406203–		(4. workshop on role of point defects/defect complexes in silicon device processing; Beaver Creek, CO (United States); 27-29 Jun 1994)			
Absts.	19:27596	*See* NREL/CP–413-7033			
CONF-9406204–		(Acta metallurgical meeting on novel magnetic structures and properties; Santa Fe, NM (United States); 24-25 Jun 1994)			
1	19:27922	*See* BNL–60437			
CONF-9406205–		(Intel supercomputing users group meeting; San Diego, CA (United States); 25-29 Jun 1994)			
1	19:28944	*See* PNL-SA–24486			
2	19:28950	*See* SAND–94-1583C			

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
3	19:28949	*See* SAND–94-1582C			
CONF-9406206–		(Intermetallics meeting; San Diego, CA (United States); 16-19 Jun 1994)			
1	19:27904	*See* LA-UR–94-1697			
CONF-9406207–		(U.S.-Japan science seminar; Sapporo (Japan); 28 Jun - 1 jul 1994)			
1	19:28568	*See* PNL-SA–24287			
CONF-9406210–		(Health Physics Society annual meeting; San Francisco, CA (United States); 27-30 Jun 1994)			
2	19:28327	*See* LA-UR–94-2203			
CONF-9406212–		(Antibes conference on nuclear shapes and nuclear structure at low excitation energies; Antibes (France); 20-25 Jun 1994)			
1	19:28680	*See* ANL/PHY/CP–83297			
CONF-9406213–		(18. annual army environmental R&D symposium; Williamsburg, VA (United States); 28-30 Jun 1994)			
1	19:28479	*See* ANL/ES/CP–82473			
3	19:28494	*See* LA-UR–94-2527			
CONF-9406219–		(American Society of Materials (ASM) AeroMat international meeting; Anaheim, CA (United States); 5-8 Jun 1994)			
1	19:27914	*See* UCRL-JC–117410			
CONF-9406220–		(North Atlantic Treaty Organization (NATO) advanced research workshop on electroceramic films; Villa Del Mar (Italy); 20 Jun 1994)			
1	19:27935	*See* SAND–94-1629C			
CONF-9406221–		(7. annual Institute for Electrical and Electronic Engineers (IEEE) symposium on computer based medical systems; Winston Salem, NC (United States); 10-11 Jun 1994)			
1-Rev.1	19:28534	*See* UCRL-JC–116175-Rev.1			
CONF-940625–		(6. AIAA/ASME thermophysics and heat transfer conference; Colorado Springs, CO (United States); 20-23 Jun 1994)			
7	19:27616	*See* LA-UR–94-2080			
8	19:27956	*See* SAND–94-1644C			
CONF-940626–		(39. international gas turbine and aeroengine congress and exposition: maintain the edge; The Hague (Netherlands); 13-16 Jun 1994)			
2	19:27220	*See* DOE/MC/21023–94/C0346			
CONF-940627–		(4. international conference and exhibition of the World Congress on Superconductivity; Orlando, FL (United States); 27 Jun - 1 jul 1994)			
2	19:28787	*See* ANL/ET/CP–82304			
3	19:27919	*See* ANL/ET/CP–82348			
CONF-940629–		(Intermag: 6th joint conference on magnetism and magnetic materials; Albuquerque, NM (United States); 20-23 Jun 1994)			
8	19:28971	*See* UCRL-JC–116424			
CONF-940630–		(11. topical meeting on the technology of fusion energy; New Orleans, LA (United States); 19-24 Jun 1994)			
25	19:28850	*See* ANL/TD/CP–82097			
26	19:28876	*See* PPPL-CFP–3082			
27	19:28882	*See* UCRL-JC–117470			
28	19:27667	*See* WHC-SA–2277			
34	19:28800	*See* ANL/TD/CP–82096			
CONF-940632–		(Annual meeting and exhibition of the Air and Waste Management Association; Cincinnati, OH (United States); 19-24 Jun 1994)			
22	19:27385	*See* PNL-SA–23055			
23	19:27490	*See* FEMP–2314			
CONF-940634–		(10. international conference on high power particle beams; San Diego, CA (United States); 20-24 Jun 1994)			
11	19:28246	*See* SAND–93-3838C			
12	19:28878	*See* SAND–93-3813C			
13	19:28833	*See* LA-UR–94-2438			
14	19:27906	*See* LA-UR–94-2437			

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
CONF-940635–		(21. European conference on controlled fusion and plasma physics; Marseilles (France); 26 Jun - 1 jul 1994)			
2	19:28839	*See* PPPL-CFP–3101			
3	19:28840	*See* PPPL-CFP–3102			
4	19:28824	*See* GA-A–21737			
CONF-940650–		(19. annual conference and exposition of the National Association of Environmental Professionals (NAEP): global strategies for environmental issues; New Orleans, LA (United States); 12-15 Jun 1994)			
3	19:27503	*See* RFP–4810			
8	19:27809	*See* PNL-SA–24290			
CONF-940657–		(17. symposium on effects of radiation on materials; Sun Valley, ID (United States); 20-23 Jun 1994)			
4	19:27910	*See* PNL-SA–24224			
CONF-940659–		(1994 ASME (Americal Society of Mechanical Engineers) fluids engineering summer meeting; Lake Tahoe, NV (United States); 19-23 Jun 1994)			
9	19:28881	*See* UCRL-JC–117404			
CONF-940664–		(ISFNT-3: 3rd international symposium on fusion nuclear technology; Los Angeles, CA (United States); 27 Jun - 1 jul 1994)			
18	19:28847	*See* ANL/TD/CP–81425			
19	19:28848	*See* ANL/TD/CP–81660			
20	19:28873	*See* PNL-SA–24165			
22	19:28872	*See* LA-UR–94-2563			
23	19:28849	*See* ANL/TD/CP–82060			
24	19:28845	*See* ANL/ET/CP–83581			
CONF-940670–		(36. power sources conference; Cherry Hill, NJ (United States); 6-9 Jun 1994)			
4	19:27795	*See* UCRL-JC–117248			
CONF-940678–		(21. international power modulator symposium; Costa Mesa, CA (United States); 28-30 Jun 1994)			
2	19:28082	*See* SAND–94-1227C			
4	19:28080	*See* SAND–93-2243C			
5	19:28100	*See* UCRL-JC–116309			
6	19:28215	*See* FNAL/C–94/182			
CONF-940684–		(1994 national thermal spray conference; Boston, MA (United States); 20-24 Jun 1994)			
4	19:28011	OSTI; NTIS; GPO Dep.	E 1.99:	DE94015414	MF-406
CONF-940697–		(International conference on perspectives for the interacting Boson model on the occasion of its 20th anniversary; Padua (Italy); 13-17 Jun 1994)			
2	19:28681	*See* ANL/PHY/CP–83538			
CONF-940701–		(Meeting on materials and mechanisms of superconductivity: high temperature superconductors; Grenoble (France); 4-9 Jul 1994)			
15	19:27920	*See* ANL/MSD/CP–83051			
CONF-940704–		(International conference on solid-to-solid phase transformations in organic materials; Pittsburgh, PA (United States); 17-22 Jul 1994)			
1	19:27886	*See* ANL/IPNS/CP–83316			
CONF-9407101–		(7. international vacuum microelectronics conference; Grenoble (France); 7 Jul 1994)			
1	19:28090	*See* SAND–94-1825C			
CONF-9407102–		(21. international power modulator symposium; Costa Mesa, CA (United States); 27-30 Jul 1994)			
1	19:28089	*See* SAND–94-1782C			
CONF-9407103–		(International conference on accelerated-driven transmutation technologies and applications; Las Vegas, NV (United States); 25-28 Jul 1994)			
1	19:27376	*See* LA-UR–94-2532			
2	19:28268	*See* WSRC-MS–94-0383			
3	19:28107	*See* ANL/TD/CP–82770			

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CONF-9407104–		(12. international system safety conference; New Orleans, LA (United States); 5-10 Jul 1994)			
1	19:28016	*See* FEMP–2341			
CONF-940711–		(25. international symposium on combustion; Irvine, CA (United States); 31 Jul - 5 aug 1994)			
17	19:28008	*See* LBL–35559			
CONF-940713–		(3. international conference on inorganic membranes; Worcester, MA (United States); 10-14 Jul 1994)			
1	19:27581	*See* ANL/ET/CP–81069			
CONF-940714–		(International meeting on synchrotron radiation instrumentation; Stony Brook, NY (United States); 18-22 Jul 1994)			
1	19:28159	*See* ANL/XFD/CP–82780			
CONF-940716–		(Conference on synchrotron radiation and materials science; Chester (United Kingdom); 3-8 Jul 1994)			
1	19:28774	*See* ANL/XFD/CP–82536			
CONF-940719–		(World congress on computational and applied mathematics; Atlanta, GA (United States); 11-15 Jul 1994)			
5	19:28957	*See* UCRL-JC–116618			
CONF-940722–		(27. international conference on high energy physics; Glasgow (United Kingdom); 21-27 Jul 1994)			
8	19:28643	*See* FNAL/C–94/152-E			
11	19:28646	*See* FNAL/C–94/158-E			
12	19:28645	*See* FNAL/C–94/155-E			
13	19:28644	*See* FNAL/C–94/154-E			
14	19:28640	*See* FNAL/C–94/141-E			
15	19:28639	*See* FNAL/C–94/138-E			
16	19:28614	*See* FNAL/C–94/159-E			
17	19:28641	*See* FNAL/C–94/146-E			
18	19:28642	*See* FNAL/C–94/151-E			
19	19:28669	*See* FNAL/C–94/153-E			
CONF-940723–		(Annual meeting of the Society of Photo-Optical Instrumentation Engineers; San Diego, CA (United States); 24-29 Jul 1994)			
4	19:27567	*See* UCRL-JC–117450			
5	19:28572	*See* UCRL-JC–117503			
6	19:28375	*See* ANL/TD/CP–81967			
8	19:28362	*See* LA-UR–94-2562			
9	19:28592	*See* LA-UR–94-2612			
10	19:28591	*See* LA-UR–94-2307			
11	19:28049	*See* ANL/ET/CP–81718			
12	19:27814	*See* PNL-SA–24444			
CONF-940726–		(31. annual international nuclear and space radiation effects conference; Tucson, AZ (United States); 18-22 Jul 1994)			
13	19:27752	*See* SAND–93-2697C			
CONF-940731–		(2. international conference on computer simulation of radiation effects; Santa Barbara, CA (United States); 24-29 Jul 1994)			
Absts.	19:27888	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94016368	MF-900
CONF-940738–		(23. DOE/NRC nuclear air cleaning and treatment conference; Buffalo, NY (United States); 25-28 Jul 1994)			
1	19:27760	*See* WSRC-MS–94-0352			
2	19:27463	*See* WHC-SA–2526			
3	19:28470	*See* PNL-SA–24626			
4	19:27854	*See* WHC-SA–2313			
CONF-940740–		(International conference on selected topics in nuclear structure; Dubna (Russian Federation); 5-9 Jul 1994)			
1	19:28679	*See* ANL/PHY/CP–82290			
CONF-940744–		(10. international zeolite conference; Garmish-Partenkirchen (Germany); 17-22 Jul 1994)			
5	19:27987	OSTI; NTIS; GPO Dep.	E 1.99:	DE94016532	MF-401

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CONF-940748–		(Institute of Nuclear Materials Management annual meeting; Naples, FL (United States); 17-20 Jul 1994)			
4	19:27536	*See* LA-UR–94-2236			
5	19:27298	*See* SAND–94-0544C			
6	19:27532	*See* DOE/CH–9404			
7	19:27530	*See* ANL/RA/CP–83425			
9	19:28507	*See* WHC-SA–2358			
10	19:27556	*See* SAND–94-1068C			
11	19:27555	*See* SAND–94-0759C			
12	19:27435	*See* WSRC-MS–94-0163			
13	19:27558	*See* SAND–94-1922C			
14	19:28946	*See* SAND–94-1156C			
15	19:28510	*See* WSRC-MS–94-0113			
16	19:27433	*See* WSRC-MS–94-0110			
17	19:27560	*See* WSRC-MS–94-0102			
18	19:27431	*See* WSRC-MS–93-412			
19	19:27432	*See* WSRC-MS–94-027			
20	19:27434	*See* WSRC-MS–94-0133			
21	19:28960	*See* WSRC-MS–94-0112			
22	19:27561	*See* WSRC-MS–94-0106			
23	19:27525	*See* WSRC-MS–94-0107			
24	19:28961	*See* WSRC-MS–94-0153P			
25	19:27299	*See* SAND–94-1923C			
41	19:27542	*See* LA-UR–94-2320			
42	19:27554	*See* SAND–94-0571C			
43	19:27540	*See* LA-UR–94-2293			
44	19:27539	*See* LA-UR–94-2292			
45	19:27541	*See* LA-UR–94-2312			
46	19:28328	*See* LA-UR–94-2313			
51	19:27297	*See* SAND–94-0374C			
52	19:27375	*See* LA-UR–94-2474			
53	19:27551	*See* LA-UR–94-2475			
54	19:27531	*See* ANL/RA/CP–83541			
55	19:27552	*See* LA-UR–94-2482			
58	19:27549	*See* LA-UR–94-2446			
59	19:27544	*See* LA-UR–94-2375			
60	19:27546	*See* LA-UR–94-2417			
64	19:27547	*See* LA-UR–94-2441			
65	19:27974	*See* LA-UR–94-2477			
66	19:27543	*See* LA-UR–94-2374			
67	19:27553	*See* LA-UR–94-2531			
68	19:27550	*See* LA-UR–94-2447			
69	19:27548	*See* LA-UR–94-2444			
70	19:27545	*See* LA-UR–94-2395			
71	19:28330	*See* LA-UR–94-2502			
72	19:27538	*See* LA-UR–94-2271			
73	19:27537	*See* LA-UR–94-2253			
CONF-940769–		(6. conference on mesoscale processes; Portland, OR (United States); 18-22 Jul 1994)			
6	19:28468	*See* PNL-SA–23559			
CONF-940776–		(20. international pyrotechnics seminar; Colorado Springs, CO (United States); 25-29 Jul 1994)			
6	19:28379	*See* SAND–94-1614C			
7	19:28391	*See* SAND–94-2028C			
CONF-940788–		(High consequence operations safety symposium; Albuquerque, NM (United States); 12-14 Jul 1994)			
3	19:28951	*See* SAND–94-1796C			
CONF-940794–		(Conference on computational learning theory; New Brunswick, NJ (United States); 10-15 Jul 1994)			
1	19:27865	*See* SAND–94-1383C			
2	19:28947	*See* SAND–94-1384C			
CONF-940796–		(Workshop on meteorites from cold and hot deserts; Noerdlingen (Germany); 20-22 Jul 1994)			
1	19:28587	*See* LA-UR–94-1588			
CONF-940798–		(Radioactive scrap metal conference; Knoxville, TN (United States); 12-14 Jul 1994)			
1	19:27817	*See* ANL/EA/CP–83307			

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CONF-940799–		(International workshop on short-term experiments under strongly reduced gravity conditions; Bremen (Germany); 4-7 Jul 1994)			
1	19:28046	*See* LBL–35669			
CONF-9408102–		(VM Goldschmidt conference; Edinburgh (United Kingdom); 29 Aug - 2 sep 1994)			
1	19:28570	*See* LA-UR–94-1668			
CONF-9408110–		(1994 groundwater modeling conference; Fort Collins, CO (United States); 10-13 Aug 1994)			
1	19:27329	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94014019	MF-903
CONF-9408111–		(2. international conference on f-elements; Helsinki (Finland); 1-6 Aug 1994)			
2	19:27986	*See* ANL/CHM/CP–83031			
CONF-9408113–		(SCES '94; Amsterdam (Netherlands); Aug 1994)			
2	19:27907	*See* LA-UR–94-2575			
CONF-9408114–		(CALORSTOCK '94 conference; Espoo (Finland); 22-25 Aug 1994)			
1	19:27793	*See* PNL-SA–22844			
CONF-9408118–		(3. international symposium on tropospheric profiling: needs and technologies; Hamburg (Germany); 30 Aug - 2 sep 1994)			
1	19:28402	*See* ANL/ER/CP–83276			
CONF-9408119–		(1994 USENIX conference; Oakland, CA (United States); 1-2 Aug 1994)			
1	19:28918	*See* ANL/ECT/CP–82953			
CONF-940812–		(29. intersociety energy conversion engineering conference; Monterey, CA (United States); 7-12 Aug 1994)			
13	19:28477	*See* ANL/ER/CP–81599			
14	19:27303	*See* ANL/CMT/CP–83184			
16	19:27608	*See* SAND–94-1492C			
17	19:27852	*See* SAND–94-1552C			
CONF-9408120–		(2. Pacific conference on computer graphics and applications and 4th international conference on CAD, CAM technology; Beijing (China); 26-29 Aug 1994)			
1	19:28916	*See* ANL/DIS/CP–82284			
CONF-9408121–		(Optical Society of America conference on high field interactions; St. Malo (France); 21-25 Aug 1994)			
1	19:28764	*See* UCRL-JC–117523			
CONF-9408122–		(2. international rapid thermal processing conference; Monterey, CA (United States); 13 Aug - 2 sep 1994)			
1	19:28093	*See* SAND–94-8713C			
CONF-9408125–		(17. international LINAC conference; Tsukuba (Japan); 21-26 Aug 1994)			
3	19:28117	*See* LA-UR–94-2483			
CONF-940813–		(208. American Chemical Society national meeting; Washington, DC (United States); 21-26 Aug 1994)			
12	19:27199	*See* ANL/CHM/CP–83166			
13	19:27200	*See* ANL/ET/CP–82796			
CONF-940815–		(International nuclear and hazardous waste management conference; Atlanta, GA (United States); 14-18 Aug 1994)			
44	19:27328	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94014103	MF-940
45	19:27420	*See* WHC-SA–2453			
51	19:27438	*See* WSRC-MS–94-0331			
52	19:27418	*See* WHC-SA–2413			
53	19:27419	*See* WHC-SA–2433			
54	19:27446	*See* WSRC-TR–94-0257			
55	19:27437	*See* WSRC-MS–94-0328			
56	19:27417	*See* WHC-SA–2335			
58	19:27436	*See* WSRC-MS–94-0274			
59	19:27335	*See* DOE/MC/30171–94/C0344			
60	19:28917	*See* ANL/EA/CP–82126			
61	19:27302	*See* ANL/CMT/CP–83059			
62	19:27306	*See* ANL/EWM/CP–82955			
63	19:27300	*See* ANL/CMT/CP–82133			

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64	19:27304	*See* ANL/ET/CP–82151			
65	19:28476	*See* ANL/CMT/CP–82156			
66	19:27301	*See* ANL/CMT/CP–82761			
67	19:27307	*See* ANL/TD/CP–83100			
68	19:27421	*See* WHC-SA–2462			
69	19:27416	*See* WHC-SA–2317			
70	19:28962	*See* WSRC-MS–94-0341			
72	19:28329	*See* LA-UR–94-2418			
74	19:27275	*See* ANL/TD/CP–82182			
CONF-940817–		(World congress in particle technology; Denver, CO (United States); 17-20 Aug 1994)			
1	19:28044	*See* ANL/ES/CP–83265			
CONF-940831–		(4. international symposium on research in high magnetic fields; Nijmegen (Netherlands); 29-31 Aug 1994)			
1	19:28076	*See* LA-UR–94-2576			
CONF-940847–		(Conference on the application of high magnetic fields; Cambridge, MA (United States); 8-12 Aug 1994)			
1	19:28580	*See* SAND–94-1748C			
2	19:28091	*See* SAND–94-1888C			
CONF-940853–		(Summer meeting of the American Institute of Chemical Engineers; Denver, CO (United States); 14-17 Aug 1994)			
1	19:27469	*See* BNL–49873			
2	19:27305	*See* ANL/EWM/CP–82897			
3	19:27422	*See* WHC-SA–2478			
4	19:28505	*See* UCRL-JC–116572			
CONF-940863–		(International conference on strongly correlated electron systems; Amsterdam (Netherlands); 15-18 Aug 1994)			
3	19:27905	*See* LA-UR–94-2272			
CONF-940871–		(European quantum electronics conference '94; Amsterdam (Netherlands); 28 Aug - 2 sep 1994)			
2	19:28101	*See* UCRL-JC–116742			
CONF-940892–		(Euro rock '94; Delph (Netherlands); 9 Aug 1994)			
2	19:27244	*See* LA-UR–94-1357			
CONF-940894–		(Annual Ecological Society of America (ESA) meeting: science and public policy; Knoxville, TN (United States); 7-11 Aug 1994)			
Absts.	19:28927	OSTI; NTIS; GPO Dep.	E 1.99:	DE94016456	MF-702
CONF-9409164–		(IPCC conference; Banff (Canada); Sep 1994)			
1	19:28885	*See* LA-UR–94-1791			
CONF-9409166–		(Electrical manufacturing and coil winding conference; Chicago, IL (United States); 27 Sep 1994)			
1	19:27791	*See* SAND–94-1715C			
2	19:28092	*See* SAND–94-1956C			
CONF-9409167–		(International Union of Theoretical and Applied Mechanics symposium on mechanics problems in geodynamics; Beijing (China); 5-9 Sep 1994)			
1	19:28571	*See* UCRL-JC–116437			
CONF-9409176–		(6. international conference on fusion reactor materials; Stressa (Italy); 27 Sep - 1 oct 1994)			
1	19:28874	*See* PNL-SA–24206			
CONF-940978–		(Symposium on liquid metal processing and casting; Santa Fe, NM (United States); 11-14 Sep 1994)			
2	19:27272	*See* LA-UR–94-2408			
CONF-940985–		(American Society for Quality Control Energy and Environmental Quality Division conference; Tucson, AZ (United States); 18-21 Sep 1994)			
4	19:27505	*See* SAND–94-0668C			
CONF-941006–		(Annual conference of the Optical Society of America and exhibit; Boston, MA (United States); 30 Oct - 4 nov 1994)			
1	19:28087	*See* SAND–94-1503C			

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CONF-9410102–		(12. annual Pacific Northwest software quality conference; Portland, OR (United States); 17-19 Oct 1994)			
1	19:28939	*See* LBL–35282			
CONF-9410103–		(10. optical fibre sensors conference; Glasgow (United Kingdom); 11-13 Oct 1994)			
1	19:28348	*See* LA-UR–94-1311			
2	19:28361	*See* LA-UR–94-1310			
CONF-9410105–		(Institute of Electrical and Electronics Engineers international Carnahan conference on security technology; Albuquerque, NM (United States); 12-14 Oct 1994)			
4	19:28948	*See* SAND–94-1556C			
7	19:27559	*See* SAND–94-1977C			
8	19:27557	*See* SAND–94-1351C			
CONF-9410116–		(1994 international display research conference; Monterey, CA (United States); 10-13 Oct 1994)			
1	19:28084	*See* SAND–94-1381C			
CONF-9410131–		(1994 hypervelocity impact symposium; Santa Fe, NM (United States); 16-20 Oct 1994)			
1	19:28054	*See* SAND–94-0083C			
2	19:28053	*See* SAND–94-0058C			
CONF-9410132–		(Microcontamination '94; San Jose, CA (United States); 5-6 Oct 1994)			
1	19:28777	*See* SAND–94-1619C			
3	19:28088	*See* SAND–94-1700C			
CONF-9410134–		(Brittle fracture safety assessment; Krefeld (Germany); Oct 1994)			
1	19:28086	*See* SAND–94-1496C			
CONF-9410140–		(17. national computer security conference; Baltimore, MD (United States); 11-14 Oct 1994)			
1	19:28938	*See* LA-UR–94-2128			
CONF-941015–		(Annual meeting of the Society of Exploration Geophysicists; Los Angeles, CA (United States); 23-27 Oct 1994)			
1	19:27959	*See* UCRL-JC–116416			
CONF-9410156–		(28. annual Asilomar conference on signals, systems, and computers; Pacific Grove, CA (United States); 31 Oct - 2 nov 1994)			
1	19:28535	*See* UCRL-JC–117704			
CONF-9410165–		(Neutron scattering; Sendai (Japan); 11-14 Oct 1994)			
2	19:28776	*See* LA-UR–94-2574			
CONF-941040–		(Application of fracture mechanics to geomaterials ASCE annual meeting; Atlanta, GA (United States); 6-14 Oct 1994)			
1	19:28569	*See* LA-UR–93-4416			
CONF-941043–		(Annual meeting of the Geothermal Resources Council; Salt Lake City, UT (United States); 3-5 Oct 1994)			
3	19:27325	*See* BNL–60503			
CONF-941046–		(11. international workshop on laser interaction and related plasma phenomena; Monterey, CA (United States); Oct 1994)			
1	19:27566	*See* LA-UR–93-4305			
CONF-941058–		(3. international conference on evolutionary computation: parallel problem solving from nature; Jerusalem (Israel); 9-14 Oct 1994)			
1	19:28935	*See* LA-UR–94-895			
CONF-941061–		(Nuclear science symposium: medical imaging conference; Norfolk, VA (United States); 30 Oct - 5 nov 1994)			
2	19:28286	*See* BNL–52423			
4	19:28287	*See* BNL–60294			
CONF-941063–		(186. meeting of the Electrochemical Society; Miami, FL (United States); 9-14 Oct 1994)			
1	19:27911	*See* SAND–94-1328C			
4	19:27955	*See* SAND–94-1309C			
5	19:27794	*See* SAND–94-1244C			

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CONF-941070–		(Computer supported cooperative symposium; Chapel Hill, NC (United States); 22-26 Oct 1994)			
1	19:28038	*See* SAND–94-0481C			
CONF-941071–		(9. ACM SIGPLAN conference on object-oriented programming system, languages and applications; Portland, OR (United States); 27 Oct 1994)			
1	19:28934	*See* LA-UR–94-575			
2	19:28952	*See* SAND–94-8227			
CONF-941074–		(21. water reactor safety information meeting; Washington, DC (United States); 25-27 Oct 1994)			
1	19:27779	*See* SAND–93-1611C			
CONF-941085–		(Visualization '94; Washington, DC (United States); 17-21 Oct 1994)			
1	19:28955	*See* UCRL-JC–116231			
2	19:28954	*See* UCRL-JC–116229			
3	19:28936	*See* LA-UR–94-1250			
4	19:28956	*See* UCRL-JC–116238			
CONF-941086–		(38. annual meeting of the Human Factors and Ergonomics Society; Nashville, TN (United States); 24-28 Oct 1994)			
1	19:27672	OSTI; NTIS; GPO Dep.	E 1.99:	DE94010127	
2	19:27855	OSTI; NTIS; GPO Dep.	E 1.99:	DE94012327	
CONF-941087–		(Symposium on low-power electronics; San Diego, CA (United States); 10-12 Oct 1994)			
1	19:28083	*See* SAND–94-1316C			
CONF-941090–		(Institute of Electrical and Electronics Engineers (IEEE) digital signal processing workshop; Yosemite, CA (United States); 3-5 Oct 1994)			
1	19:28040	*See* SAND–94-1175C			
2	19:28039	*See* SAND–94-0624C			
CRN-PN–					
91-11	19:28718	OSTI; NTIS (US Sales Only); INIS		DE94633319	
91-17	19:28719	OSTI; NTIS (US Sales Only); INIS		DE94633320	
CTH-HDR-P–					
93-12	19:27619	*See* NUTEK-GT–94-1			
DESY–					
93-199	19:28294	OSTI; NTIS (US Sales Only); INIS		DE94790017	
93-200	19:28295	OSTI; NTIS (US Sales Only); INIS		DE94790016	
94-018	19:28575	OSTI; NTIS (US Sales Only); INIS		DE94789713	
94-020	19:28630	OSTI; NTIS (US Sales Only); INIS		DE94789711	
94-028	19:28602	OSTI; NTIS (US Sales Only); INIS		DE94789710	
94-034	19:28607	OSTI; NTIS (US Sales Only); INIS		DE94789689	
94-035	19:28631	OSTI; NTIS (US Sales Only); INIS		DE94789688	
94-036	19:28608	OSTI; NTIS (US Sales Only); INIS		DE94789687	
94-041	19:28632	OSTI; NTIS (US Sales Only); INIS		DE94789685	
94-042	19:28633	OSTI; NTIS (US Sales Only); INIS		DE94789684	
94-043	19:28609	OSTI; NTIS (US Sales Only); INIS		DE94789683	
94-044	19:28634	OSTI; NTIS (US Sales Only); INIS		DE94789664	
94-045	19:28610	OSTI; NTIS (US Sales Only); INIS		DE94789715	
94-046	19:28603	OSTI; NTIS (US Sales Only); INIS		DE94789682	
94-047	19:28635	OSTI; NTIS (US Sales Only); INIS		DE94789714	
94-048	19:28296	OSTI; NTIS (US Sales Only); INIS		DE94789665	
94-051	19:28636	OSTI; NTIS (US Sales Only); INIS		DE94789638	
94-054	19:28604	OSTI; NTIS (US Sales Only); INIS		DE94789712	
94-056	19:28637	OSTI; NTIS (US Sales Only); INIS		DE94789632	
94-057	19:28611	OSTI; NTIS (US Sales Only); INIS		DE94789633	
94-058	19:28576	OSTI; NTIS (US Sales Only); INIS		DE94789619	
94-061	19:28668	OSTI; NTIS (US Sales Only); INIS		DE94789639	
94-067	19:28612	OSTI; NTIS (US Sales Only); INIS		DE94789635	
DOE–					
94016533	19:27805	OSTI; NTIS; GPO Dep.	E 1.99:	DE94016533	MF-902
DOE-EM-STD–					
5502-94	19:28887	OSTI; NTIS; GPO Dep.	E 1.99:	DE94016623	MF-500
DOE-STD–					
1064-94	19:27818	OSTI; NTIS; GPO Dep.	E 1.99:	DE94014954	MF-500
1070-94	19:28889	OSTI; NTIS; GPO Dep.	E 1.99:	DE94015536	MF-500
1071-94	19:27819	OSTI; NTIS; GPO Dep.	E 1.99:	DE94014949	MF-500
1072-94	19:27820	OSTI; NTIS; GPO Dep.	E 1.99:	DE94014948	MF-500

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DOE/BC–					
93/4	19:27245	OSTI; NTIS; GPO Dep.	E 1.99:	DE94000127	PC-122
DOE/BC/14475–					
T1	19:27241	OSTI; NTIS; GPO Dep.	E 1.99:	DE94015874	MF-122
DOE/BC/14479–					
T1	19:27265	OSTI; NTIS; GPO Dep.	E 1.99:	DE94015875	MF-123
T2	19:27266	OSTI; NTIS; GPO Dep.	E 1.99:	DE94015876	MF-123
DOE/BP–					
2267	19:27792	OSTI; NTIS; GPO Dep.	E 1.99:	DE94015997	MF-900
2289	19:28884	OSTI; NTIS; GPO Dep.	E 1.99:	DE94015994	MF-902
2395	19:27829	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94015993	MF-900
561(11/92)	19:27583	OSTI; NTIS; GPO Dep.	E 1.99:	DE94015989	MF-900
67(12/91)	19:27582	OSTI; NTIS; GPO Dep.	E 1.99:	DE94015990	MF-920
DOE/BP/01610–					
2	19:28512	OSTI; NTIS; GPO Dep.	E 1.99:	DE94016039	MF-902
DOE/BP/07084–					
3	19:27584	OSTI; NTIS; GPO Dep.	E 1.99:	DE94016042	MF-902
4	19:27585	OSTI; NTIS; GPO Dep.	E 1.99:	DE94016041	MF-902
DOE/BP/10891–					
1	19:27586	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94016767	MF-902
DOE/BP/13084–					
6	19:27587	OSTI; NTIS; GPO Dep.	E 1.99:	DE94015991	MF-902
DOE/BP/60559–					
1	19:27588	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94016387	MF-902
DOE/BP/80397–					
1	19:27589	OSTI; NTIS; GPO Dep.	E 1.99:	DE94015999	MF-902
DOE/BP/93497–					
T1	19:27590	OSTI; NTIS; GPO Dep.	E 1.99:	DE94013191	MF-902
DOE/CE/15566–					
T3	19:28370	OSTI; NTIS; GPO Dep.	E 1.99:	DE94016489	MF-1425
DOE/CE/15600–					
T2	19:27246	OSTI; NTIS; GPO Dep.	E 1.99:	DE94015655	MF-123
DOE/CE/23810–					
34	19:27988	OSTI; NTIS; GPO Dep.	E 1.99:	DE94016949	MF-1600
42A	19:27944	OSTI; NTIS; GPO Dep.	E 1.99:	DE94016646	MF-1600
DOE/CH–					
9404	19:27532	OSTI; NTIS; GPO Dep.	E 1.99:	DE94015169	MF-515
DOE/DP–					
0125	19:28012	OSTI; NTIS; GPO Dep.	E 1.99:	DE94016143	MF-702
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0845	19:27450	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94015405	MF-630
0851	19:27330	OSTI; NTIS; GPO Dep.	E 1.99:	DE94015404	MF-630
0877	19:27470	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94017169	MF-630
0882	19:27806	OSTI; NTIS; GPO Dep.	E 1.99:	DE94015409	MF-630
0903	19:27807	OSTI; NTIS; GPO Dep.	E 1.99:	DE94015411	MF-630
0904	19:28480	OSTI; NTIS; GPO Dep.	E 1.99:	DE94015333	MF-902
0907	19:28481	OSTI; NTIS; GPO Dep.	E 1.99:	DE94015407	MF-630
0919	19:27830	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94015412	MF-630
0923	19:27837	OSTI; NTIS; GPO Dep.	E 1.99:	DE94015410	MF-630
0943	19:28482	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94015403	MF-630
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0009-Vol.3	19:27838	OSTI; NTIS; GPO Dep.	E 1.99:	DE94006577	MF-350
DOE/EH–					
0353P	19:27471	OSTI; NTIS; GPO Dep.	E 1.99:	DE94016016	MF-600
94016136	19:27472	OSTI; NTIS; GPO Dep.	E 1.99:	DE94016136	MF-630
94016137	19:27473	OSTI; NTIS; GPO Dep.	E 1.99:	DE94016137	MF-630
94016138	19:27474	OSTI; NTIS; GPO Dep.	E 1.99:	DE94016138	MF-630
94016139	19:27475	OSTI; NTIS; GPO Dep.	E 1.99:	DE94016139	MF-630
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0035(94/07)	19:27822	OSTI; NTIS; GPO; GPO Dep.	E 1.99:	DE94015819	MF-950
0109(94/07)	19:27247	OSTI; NTIS; GPO Dep.	E 1.99:	DE94015827	MF-950
0130(94/06)	19:27260	OSTI; NTIS; GPO; GPO Dep.	E 1.99:	DE94012255	MF-950
0130(94/07)	19:27261	OSTI; NTIS; GPO; GPO Dep.	E 1.99:	DE94015717	MF-950
0149(93)	19:28965	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94015840	MF-950
0191(93)	19:27831	OSTI; NTIS; GPO; GPO Dep.	E 1.99:	DE94015595	MF-950
0202(94)	19:27240	OSTI; NTIS; INIS; GPO; GPO Dep.	E 1.99:	DE94016956	MF-950
0202(94/3Q)	19:27823	OSTI; NTIS; GPO Dep.	E 1.99:	DE94016711	MF-950
0226(94/07)	19:27832	OSTI; NTIS; GPO Dep.	E 1.99:	DE94015567	MF-950

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0380(94/07)	19:27248	OSTI; NTIS; GPO; GPO Dep.	E 1.99:	DE94015144	MF-950
0384(93)	19:27824	OSTI; NTIS; INIS; GPO; GPO Dep.	E 1.99:	DE94015828	MF-950
0520(94/07)	19:27249	OSTI; NTIS; GPO Dep.	E 1.99:	DE94015837	MF-950
0542(95)	19:27262	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94016592	MF-950
0543(94/1Q)	19:27250	OSTI; NTIS; GPO; GPO Dep.	E 1.99:	DE94015459	MF-950
0569(94/2Q)	19:27825	OSTI; NTIS; GPO Dep.	E 1.99:	DE94015951	MF-950
DOE/EIA/TR–					
0568	19:27251	OSTI; NTIS; GPO; INIS; GPO Dep.	E 1.99:	DE94015132	MF-950
DOE/EIS–					
0158-S	19:27254	OSTI; NTIS; GPO Dep.	E 1.99:	DE94015408	MF-630
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0177-Vol.2	19:27331	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94016637	MF-940
0177-Vol.3	19:27332	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94016638	MF-940
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30201-H1-Vol.1	19:27992	OSTI; NTIS; GPO Dep.	E 1.99:	DE94015889	MF-400
30201-H1-Vol.2	19:27993	OSTI; NTIS; GPO Dep.	E 1.99:	DE94015890	MF-400
DOE/ER/13296–					
10	19:27989	OSTI; NTIS; GPO Dep.	E 1.99:	DE94017151	MF-401
DOE/ER/13387–					
74	19:27595	OSTI; NTIS; GPO Dep.	E 1.99:	DE94016640	MF-401
DOE/ER/13439–					
T4	19:28007	OSTI; NTIS; GPO Dep.	E 1.99:	DE94016642	MF-401
DOE/ER/13508–					
8	19:28762	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94015339	MF-414
DOE/ER/13591–					
8	19:27964	OSTI; NTIS; GPO Dep.	E 1.99:	DE94016427	MF-401
DOE/ER/13811–					
6	19:28371	OSTI; NTIS; GPO Dep.	E 1.99:	DE94017155	MF-401
DOE/ER/13974–					
T2	19:27945	OSTI; NTIS; GPO Dep.	E 1.99:	DE94016953	MF-401
DOE/ER/14052–					
1	19:28168	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94016492	MF-414
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T1	19:27990	OSTI; NTIS; GPO Dep.	E 1.99:	DE94015309	MF-401
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4	19:28763	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94015487	MF-411
DOE/ER/14252–					
1	19:27965	OSTI; NTIS; GPO Dep.	E 1.99:	DE94016180	MF-404
2	19:27966	OSTI; NTIS; GPO Dep.	E 1.99:	DE94016181	MF-404
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T1	19:27991	OSTI; NTIS; GPO Dep.	E 1.99:	DE94016431	MF-401
DOE/ER/14328–					
1	19:28483	OSTI; NTIS; GPO Dep.	E 1.99:	DE94015668	MF-403
DOE/ER/20041–					
2	19:28526	OSTI; NTIS; GPO Dep.	E 1.99:	DE94015712	MF-408
DOE/ER/25114–					
1	19:28966	OSTI; NTIS; GPO Dep.	E 1.99:	DE94015308	MF-405
DOE/ER/25176–					
1	19:28928	OSTI; NTIS; GPO Dep.	E 1.99:	DE94016429	MF-405
DOE/ER/40270–					
53	19:28720	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94015488	MF-413
DOE/ER/40509–					
4	19:28596	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94015483	MF-414
DOE/ER/40561–					
147	19:28613	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94014975	MF-414
DOE/ER/40684–					
4	19:28597	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94015519	MF-414
DOE/ER/40747–					
10	19:28125	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94015631	MF-414
DOE/ER/40759–					
2	19:28169	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94017150	MF-414
DOE/ER/45308–					
7	19:27889	OSTI; NTIS; GPO Dep.	E 1.99:	DE94015482	MF-404; MF-406
DOE/ER/45328–					
8	19:27890	OSTI; NTIS; GPO Dep.	E 1.99:	DE94016947	MF-404
DOE/ER/45364–					
T4	19:28770	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94015653	MF-404
DOE/ER/45366–					
6	19:27946	OSTI; NTIS; GPO Dep.	E 1.99:	DE94015415	MF-404

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
DOE/ER/45400–					
T6	19:27947	OSTI; NTIS; GPO Dep.	E 1.99:	DE94016040	MF-404
DOE/ER/53194–					
4	19:28802	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94016223	MF-420
DOE/ER/53198–					
242	19:28851	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94015535	PC-426
243	19:28852	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94016771	PC-426
244	19:28853	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94016770	PC-426
DOE/ER/53212–					
241	19:28803	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94015534	PC-427
DOE/ER/54157–					
3	19:28804	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94016820	MF-420
DOE/ER/54181–					
2	19:28859	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94016182	MF-423
DOE/ER/54241–					
131	19:28819	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94015854	MF-426
132	19:28820	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94015855	MF-427
DOE/ER/60372–					
9	19:28460	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94016115	MF-402
DOE/ER/60634–					
T5	19:28550	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94015654	MF-408
DOE/ER/61395–					
T2	19:28537	OSTI; NTIS; GPO Dep.	E 1.99:	DE94013464	MF-408
DOE/ER/61464–					
2	19:28513	OSTI; NTIS; GPO Dep.	E 1.99:	DE94013771	MF-408
DOE/ER/61484–					
08	19:28484	OSTI; NTIS; GPO Dep.	E 1.99:	DE94017149	MF-408
DOE/ER/61502–					
1	19:28529	OSTI; NTIS; GPO Dep.	E 1.99:	DE94014676	MF-408
DOE/ER/61716–					
1	19:28514	OSTI; NTIS; GPO Dep.	E 1.99:	DE94016534	MF-403
DOE/ER/75728–					
2	19:27660	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94016226	MF-400
DOE/ET/20279–					
T16	19:27604	OSTI; NTIS; GPO Dep.	E 1.99:	DE94015478	MF-1290
T17	19:27595	OSTI; NTIS; GPO Dep.	E 1.99:	DE94015479	MF-1290
DOE/ET/53088–					
665	19:28638	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94016859	MF-420
DOE/EW/53023–					
T7	19:28515	OSTI; NTIS; GPO Dep.	E 1.99:	DE94016037	MF-902
DOE/FE–					
0217P(1/94)	19:27193	OSTI; NTIS; GPO Dep.	E 1.99:	DE94015886	MF-101
0300	19:27252	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94015884	MF-123
0302	19:27828	OSTI; NTIS; GPO Dep.	E 1.99:	DE94015888	MF-123
0312	19:27263	OSTI; NTIS; GPO Dep.	E 1.99:	DE94015883	MF-131
0313	19:27255	OSTI; NTIS; GPO Dep.	E 1.99:	DE94015885	MF-126
DOE/FTR–					
94006183	19:28112	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE94006183	MF-414
94007261	19:27796	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE94007261	MF-310
94008239	19:27797	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE94008239	MF-270
94008610	19:27605	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE94008610	MF-270
94009138	19:27798	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE94009138	MF-270; MF-261; MF-247
94009139	19:27617	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE94009139	MF-250
94009143	19:27606	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE94009143	MF-232
94009527	19:28297	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE94009527	MF-414
94009531	19:28072	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE94009531	MF-706
DOE/ID–					
10293	19:27880	OSTI; NTIS (documentation only); ESTSC (complete software package), P.O. Box 1020, Oak Ridge, TN 37831-1020; GPO Dep.	E 1.99:	DE94015257	MF-1501
10421	19:27881	OSTI; NTIS; GPO Dep.	E 1.99:	DE94015245	MF-1411
10422-Vol.1	19:27533	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94015246	MF-526
10422-Vol.2	19:27534	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94015247	MF-526
10422-Vol.3	19:27535	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94015248	MF-526
10422-Vol.4	19:27269	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94015249	MF-526
10426	19:27882	OSTI; NTIS; GPO Dep.	E 1.99:	DE94015258	MF-1501

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
10453-Pt.1	19:27333	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94015238	MF-902
10453-Pt.2	19:27334	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94015239	MF-902
DOE/ID/12735–					
T31	19:28485	OSTI; NTIS; GPO Dep.	E 1.99:	DE94017038	MF-902
DOE/ID/12842–					
3	19:27242	OSTI; NTIS; GPO Dep.	E 1.99:	DE94000136	PC-122
DOE/LLW–					
201-Rev.1	19:28967	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94015259	MF-900
DOE/MC/10637–					
3742	19:27201	OSTI; NTIS; GPO Dep.	E 1.99:	DE94004116	MF-109; MF-113
3820	19:27194	OSTI; NTIS; GPO Dep.	E 1.99:	DE94004111	MF-104
DOE/MC/21023–					
94/C0346	19:27220	OSTI; NTIS; GPO Dep.	E 1.99:	DE94015714	MF-103
DOE/MC/24207–					
3322	19:27221	OSTI; NTIS; GPO Dep.	E 1.99:	DE94004090	MF-103
3473	19:27222	OSTI; NTIS; GPO Dep.	E 1.99:	DE94000013	MF-103
DOE/MC/25038–					
3652	19:27215	OSTI; NTIS; GPO Dep.	E 1.99:	DE94000006	MF-109
3817	19:27216	OSTI; NTIS; GPO Dep.	E 1.99:	DE94015300	MF-109
3818	19:27202	OSTI; NTIS; GPO Dep.	E 1.99:	DE94015301	MF-109
3821	19:27217	OSTI; NTIS; GPO Dep.	E 1.99:	DE94016721	MF-113
DOE/MC/26042–					
3806	19:27203	OSTI; NTIS; GPO Dep.	E 1.99:	DE94016724	MF-106
DOE/MC/28130–					
3721	19:27258	OSTI; NTIS; GPO Dep.	E 1.99:	DE94004109	MF-132
DOE/MC/29246–					
3773	19:27204	OSTI; NTIS; GPO Dep.	E 1.99:	DE94004138	MF-106; MF-113
3839	19:27205	OSTI; NTIS; GPO Dep.	E 1.99:	DE94012271	MF-106
DOE/MC/30171–					
94/C0344	19:27335	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94014873	MF-902; MF-940
DOE/MC/30246–					
3844	19:27629	OSTI; NTIS; GPO Dep.	E 1.99:	DE94012276	MF-111
DOE/METC/C–					
94/7126	19:27259	OSTI; NTIS; GPO Dep.	E 1.99:	DE94015150	MF-132
DOE/MWIP–					
20	19:27336	OSTI; NTIS; INIS; GPO Dep	E 1.99:	DE94015451	MF-902; MF-940
27	19:27476	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94016453	MF-902
29	19:27337	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94015425	MF-900
DOE/NASA–					
0336-4	19:27876	OSTI; NTIS; GPO Dep.	E 1.99:	DE94016854	MF-1502
DOE/NV–					
365	19:28385	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94016712	MF-900
373	19:27338	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94015593	MF-700
DOE/NV/10412–					
9	19:27243	OSTI; NTIS; GPO Dep.	E 1.99:	DE94015520	MF-1241
10	19:27621	OSTI; NTIS; GPO Dep.	E 1.99:	DE94015521	MF-1241
DOE/NV/10845–					
38	19:28486	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94015656	MF-702
DOE/NV/11432–					
139	19:28461	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94016802	MF-702
DOE/OR–					
01-1194-D2	19:27477	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94015940	MF-902
01-1252-D1	19:27478	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94015937	MF-902
DOE/OR/00033–					
T589	19:28888	OSTI; NTIS; GPO Dep.	E 1.99:	DE94015957	MF-400
T592	19:27833	OSTI; NTIS; GPO Dep.	E 1.99:	DE94015958	MF-1321
T593	19:27834	OSTI; NTIS; GPO Dep.	E 1.99:	DE94015959	MF-1321
DOE/PC/79926–					
T2	19:27206	OSTI; NTIS; GPO Dep.	E 1.99:	DE94009903	MF-108
DOE/PC/88654–					
T10	19:27225	OSTI; NTIS; GPO Dep.	E 1.99:	DE94016021	MF-102
T11	19:27226	OSTI; NTIS; GPO Dep.	E 1.99:	DE94016022	MF-102

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
T12	19:27227	OSTI; NTIS; GPO Dep.	E 1.99:	DE94016023	MF-102
T13	19:27228	OSTI; NTIS; GPO Dep.	E 1.99:	DE94016024	MF-102
T14	19:27229	OSTI; NTIS; GPO Dep.	E 1.99:	DE94016025	MF-102
T15	19:27230	OSTI; NTIS; GPO Dep.	E 1.99:	DE94016026	MF-102
T16	19:27231	OSTI; NTIS; GPO Dep.	E 1.99:	DE94016027	MF-102
T17	19:27232	OSTI; NTIS; GPO Dep.	E 1.99:	DE94016028	MF-102
T18	19:27233	OSTI; NTIS; GPO Dep.	E 1.99:	DE94016029	MF-102
T8	19:27223	OSTI; NTIS; GPO Dep.	E 1.99:	DE94016019	MF-102
T9	19:27224	OSTI; NTIS; GPO Dep.	E 1.99:	DE94016020	MF-102
DOE/PC/89659–					
T16-App.-Bk.1	19:27630	OSTI; NTIS; GPO Dep.	E 1.99:	DE94013053	MF-105
DOE/PC/90055–					
T14	19:27207	OSTI; NTIS; GPO Dep.	E 1.99:	DE94015608	MF-108
DOE/PC/90287–					
T14	19:27195	OSTI; NTIS; GPO Dep.	E 1.99:	DE94017124	MF-102
DOE/PC/90293–					
T13	19:27208	OSTI; NTIS; GPO Dep.	E 1.99:	DE94017125	MF-113
DOE/PC/90350–					
T5	19:27836	OSTI; NTIS; GPO Dep.	E 1.99:	DE94017112	MF-112
DOE/PC/90544–					
T13	19:27631	OSTI; NTIS; GPO Dep.	E 1.99:	DE94016034	MF-105
T14	19:27211	OSTI; NTIS; GPO Dep.	E 1.99:	DE94016052	MF-105
DOE/PC/90547–					
T15	19:27634	OSTI; NTIS; GPO Dep.	E 1.99:	DE94016003	MF-105
DOE/PC/91292–					
T11	19:27234	OSTI; NTIS; GPO Dep.	E 1.99:	DE94016030	MF-104
DOE/PC/91310–					
T10	19:27196	OSTI; NTIS; GPO Dep.	E 1.99:	DE94016006	MF-113
DOE/PC/92111–					
5	19:27926	OSTI; NTIS; GPO Dep.	E 1.99:	DE94013933	MF-125
DOE/PC/92158–					
T7	19:27632	OSTI; NTIS; GPO Dep.	E 1.99:	DE94016005	MF-104
DOE/PC/92521–					
T153	19:27197	OSTI; NTIS; GPO Dep.	E 1.99:	DE94016035	MF-105
DOE/PC/92527–					
T6	19:27210	OSTI; NTIS; GPO Dep.	E 1.99:	DE94016002	MF-108
DOE/PC/92539–					
7	19:27235	OSTI; NTIS; GPO Dep.	E 1.99:	DE94016017	MF-103
DOE/PC/92547–					
T4	19:27198	OSTI; NTIS; GPO Dep.	E 1.99:	DE94014515	MF-102
DOE/PC/93214–					
T3	19:27212	OSTI; NTIS; GPO Dep.	E 1.99:	DE94016033	MF-105
DOE/PO–					
0021	19:27856	OSTI; NTIS; GPO Dep.	E 1.99:	DE94013377	MF-900
0025	19:27253	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94015887	MF-930
0026	19:27857	OSTI; NTIS; GPO Dep.	E 1.99:	DE94014300	MF-900
DOE/RL–					
90-21	19:27479	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94016324	MF-902; MF-940
93-24-7	19:27451	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94015638	MF-905; MF-940
93-24-9	19:28929	OSTI; NTIS; GPO Dep.	E 1.99:	DE94015647	MF-900
93-29	19:27480	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94015670	MF-940
93-37	19:27452	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94015330	MF-902
93-79	19:27339	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94015648	MF-903
93-99	19:27340	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94015713	MF-902
94-22	19:27341	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94016323	MF-902
94-24	19:27342	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94015763	MF-902
94-25	19:27213	OSTI; NTIS; GPO Dep.	E 1.99:	DE94015379	MF-902
94-26	19:27214	OSTI; NTIS; GPO Dep.	E 1.99:	DE94015378	MF-902
94-28	19:27867	OSTI; NTIS; GPO Dep.	E 1.99:	DE94015334	MF-902
94-51	19:27453	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94016462	MF-630
DOE/RL/10930–					
T2	19:27481	OSTI; NTIS; GPO Dep.	E 1.99:	DE94016326	MF-510
DOE/RW–					
0051/Rev.3	19:27343	OSTI (Free of Charge); INIS		TI94015397	MF-800
0441	19:27345	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94015371	MF-810
0444	19:27280	OSTI (Free of Charge); INIS		TI94016111	MF-820
DOE/RW/00134–					
T11	19:27454	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94015954	MF-814
T12	19:27344	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94015955	MF-814

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
DOE/SR/15191–					
8	19:27868	OSTI; NTIS; GPO Dep.	E 1.99:	DE94017153	MF-702
DOE/SR/15199–					
17	19:28487	OSTI; NTIS; GPO Dep.	E 1.99:	DE94016173	MF-400
DOE/SR/18217–					
3	19:28551	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94017158	MF-600
DPSTSA–					
200-10-Suppl.4-Del.Ver.	19:27482	OSTI; NTIS; GPO Dep.	E 1.99:	DE94015634	MF-721
DPW–					
53-1355	19:27684	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE94011766	MF-700
55-131	19:27483	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE94011765	MF-700
56-135	19:27994	OSTI; NTIS; GPO Dep.	E 1.99:	DE94016650	MF-706
56-179	19:27673	OSTI; NTIS; GPO Dep.	E 1.99:	DE94016648	MF-704
DTH-LV–					
92-39	19:27611	OSTI; NTIS		DE94783309	
93-2	19:27612	OSTI; NTIS		DE94783293	
93-10	19:27613	OSTI; NTIS		DE94783294	
93-31	19:27615	OSTI; NTIS		DE94783295	
94-06	19:27614	OSTI; NTIS		DE94783296	
DUN–					
1838-RD	19:27685	OSTI; NTIS; GPO Dep.	E 1.99:	DE94015113	MF-500
3333-Del.	19:27686	OSTI; NTIS; GPO Dep.	E 1.99:	DE94015677	MF-500
4745-Del.	19:27687	OSTI; NTIS; GPO Dep.	E 1.99:	DE94015118	MF-520
959	19:27680	OSTI; NTIS; GPO Dep.	E 1.99:	DE94016515	MF-502
ECN-C–					
93-065	19:27640	OSTI; NTIS; INIS		DE94789634	
93-086	19:27346	OSTI; NTIS; INIS		DE94789663	
93-095	19:27347	OSTI; NTIS; INIS		DE94789631	
94-015	19:28752	OSTI; NTIS; INIS		DE94785929	
ECN-I–					
93-026	19:27688	OSTI; NTIS; INIS		DE94789642	
93-027	19:27689	OSTI; NTIS; INIS		DE94789641	
93-033	19:27644	OSTI; NTIS; INIS		DE94789640	
93-035	19:27690	OSTI; NTIS; INIS		DE94789660	
93-049	19:27348	OSTI; NTIS; INIS		DE94789636	
93-052	19:27768	OSTI; NTIS; INIS		DE94789637	
93-057	19:28860	OSTI; NTIS; INIS		DE94789659	
94-002	19:27691	OSTI; NTIS; INIS		DE94789662	
94-010	19:27692	OSTI; NTIS; INIS		DE94785928	
94-011	19:27693	OSTI; NTIS; INIS		DE94789661	
94-014	19:27694	OSTI; NTIS; INIS		DE94785927	
94-015	19:27695	OSTI; NTIS; INIS		DE94785926	
ECN-R–					
94-001	19:27349	OSTI; NTIS; INIS		DE94789630	
94-003	19:28861	OSTI; NTIS; INIS		DE94785925	
EDF-DER-RA–					
1993-2	19:28890	OSTI; NTIS (US Sales Only); INIS		DE94632954	
EDR–					
16624	19:27876	*See* DOE/NASA–0336-4			
EGG–					
11265-1012	19:28488	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94016772	MF-702
11265-2022	19:28489	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94013545	MF-702
11265-2059	19:28490	OSTI; NTIS; GPO Dep.	E 1.99:	DE94016798	MF-702
1183-6	19:28013	OSTI; NTIS; GPO Dep.	E 1.99:	DE94015392	MF-700
1183-1022	19:27696	OSTI; NTIS; GPO Dep.	E 1.99:	DE94014957	MF-700
1183-1218	19:28014	OSTI; NTIS; GPO Dep.	E 1.99:	DE94015927	MF-700
1183-1219	19:28393	OSTI; NTIS; GPO Dep.	E 1.99:	DE94015928	MF-700
1183-1262	19:28386	OSTI; NTIS; GPO Dep.	E 1.99:	DE94015388	MF-700
1183-2349	19:28298	OSTI; NTIS; GPO Dep.	E 1.99:	DE94015831	MF-706
1183-281	19:28392	OSTI; NTIS; GPO Dep.	E 1.99:	DE94015929	MF-706
1183-4118	19:28862	OSTI; NTIS; GPO Dep.	E 1.99:	DE94016528	MF-706
1183-4119	19:28863	OSTI; NTIS; GPO Dep.	E 1.99:	DE94015387	MF-706
1183-5068	19:27622	OSTI; NTIS; GPO Dep.	E 1.99:	DE94015391	MF-706
1183-5074	19:27618	OSTI; NTIS; GPO Dep.	E 1.99:	DE94015127	MF-703
2716-Vol.5	19:28009	*See* NUREG/CR–6116-Vol.5			
2716-Vol.7	19:27774	*See* NUREG/CR–6116-Vol.7			
2717	19:27643	*See* NUREG/CR–6121			
EGG-B–					
3258	19:28392	*See* EGG–1183-281			

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
EGG-CIET–					
11057	19:27455	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94015317	MF-902
11058	19:27456	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94015320	MF-902
11127	19:28516	OSTI; NTIS; GPO Dep.	E 1.99:	DE94015256	MF-902
11270	19:28462	OSTI; NTIS; GPO Dep.	E 1.99:	DE94015264	
EGG-CS–					
11209	19:28968	OSTI; NTIS; GPO Dep.	E 1.99:	DE94015322	MF-405
EGG-EE–					
11298-Pt.1	19:28930	OSTI; NTIS; GPO Dep.	E 1.99:	DE94015253	MF-906
11298-Pt.2	19:28931	OSTI; NTIS; GPO Dep.	E 1.99:	DE94015393	MF-906
EGG-ME–					
11131	19:28387	OSTI; NTIS; GPO Dep.	E 1.99:	DE94015291	
EGG-MS–					
10941	19:27350	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94015316	MF-940; MF-906
11063	19:27948	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94015262	MF-901; MF-905
EGG-NRE–					
11236	19:27967	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94015319	MF-940
EGG-RAAM–					
11182	19:28932	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94015382	
11278	19:27862	OSTI; NTIS; GPO Dep.	E 1.99:	DE94015272	MF-900
EGG-RWMC–					
11190	19:27351	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94015385	MF-902
EGG-SSRE–					
9747	19:27571	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94015270	
EGG-WM–					
10924	19:27352	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94010706	MF-940
11011	19:28015	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94015254	MF-940
11053	19:27353	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94015383	MF-940
11105	19:27354	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94008526	MF-940
11344	19:28933	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94015292	MF-905
8773	19:27484	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94016278	MF-902; MF-907
EGG-WROC–					
11148	19:27457	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94015321	MF-940; MF-902
11152	19:27355	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94015255	MF-902
EGG-WTD–					
11161	19:27485	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94015265	MF-901; MF-902
11191	19:27486	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94015384	MF-902; MF-940
11199	19:27356	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94015260	MF-940
11208	19:27357	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94015289	MF-906
11271	19:27358	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94015261	MF-940
11310	19:27487	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94015294	MF-902; MF-906
11311	19:27488	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94015293	MF-940
ERA-NRE–					
94-016	19:27697	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94015252	MF-520
ETDE-GB–					
630	19:27264	OSTI; NTIS (US Sales Only); INIS		DE94787531	
FE-MIT–					
92111-5	19:27926	*See* DOE/PC/92111–5			
FEI–					
2254	19:28753	OSTI; NTIS (US Sales Only); INIS		DE94633340	
2276	19:28754	OSTI; NTIS (US Sales Only); INIS		DE94633341	
FEMP–					
2303	19:27489	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94016581	MF-902; MF-940
2314	19:27490	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94015812	MF-900
2318	19:27491	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94015807	MF-940
2322	19:27492	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94016580	MF-902; MF-940
2324	19:27359	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94015814	MF-940
2328	19:27493	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94015811	MF-900
2330	19:27494	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94015813	MF-902
2341	19:28016	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94015815	MF-706
FNAL-TM–					
1871	19:28073	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94015850	MF-906

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
1892	19:28301	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94015843	MF-414
1893	19:28216	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94015725	MF-414
1894	19:28302	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94015726	MF-414
1895	19:28303	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94015187	MF-414
FNAL/C–					
94/138-E	19:28639	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94015381	MF-414
94/140	19:28299	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94014990	MF-414
94/141-E	19:28640	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94015185	MF-414
94/146-E	19:28641	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94015727	MF-414
94/151-E	19:28642	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94016334	MF-414
94/152-E	19:28643	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94014988	MF-414
94/153-E	19:28669	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94016335	MF-414
94/154-E	19:28644	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94015184	MF-414
94/155-E	19:28645	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94015188	MF-414
94/158-E	19:28646	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94015183	MF-414
94/159-E	19:28614	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94015543	MF-414
94/180-E	19:28647	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94015537	MF-414
94/181	19:28113	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94015524	MF-414
94/182	19:28215	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94015542	MF-414
94/183	19:28300	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94015525	MF-414
94/185-E	19:28648	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94015546	MF-414
94/191	19:28140	OSTI; NTIS; GPO Dep.	E 1.99:	DE94015545	MF-405
94/192	19:28114	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94015539	MF-414
FRCEA-TH–					
392	19:28517	OSTI; NTIS (US Sales Only); INIS		DE94632214	
394	19:27895	OSTI; NTIS (US Sales Only); INIS		DE94631703	
397	19:27927	OSTI; NTIS (US Sales Only); INIS		DE94631916	
398	19:27565	OSTI; NTIS (US Sales Only); INIS		DE94632478	
400	19:27360	OSTI; NTIS (US Sales Only); INIS		DE94632845	
401	19:28552	OSTI; NTIS (US Sales Only); INIS		DE94632368	
414	19:28553	OSTI; NTIS (US Sales Only); INIS		DE94632323	
415	19:27995	OSTI; NTIS (US Sales Only); INIS		DE94631537	
416	19:28792	OSTI; NTIS (US Sales Only); INIS		DE94633494	
417	19:28793	OSTI; NTIS (US Sales Only); INIS		DE94633495	
418	19:27361	OSTI; NTIS (US Sales Only); INIS		DE94632832	
420	19:27458	OSTI; NTIS (US Sales Only); INIS		DE94632357	
421	19:28755	OSTI; NTIS (US Sales Only); INIS		DE94633342	
422	19:28304	OSTI; NTIS (US Sales Only); INIS		DE94632804	
423	19:28305	OSTI; NTIS (US Sales Only); INIS		DE94632805	
FRCR–					
446	19:28819	*See* DOE/ER/54241–131			
447	19:28820	*See* DOE/ER/54241–132			
FRNC-TH–					
3735	19:27896	OSTI; NTIS (US Sales Only); INIS		DE94631947	
FVU–					
94-2	19:27869	OSTI; NTIS		DE94783393	
94-4	19:27870	OSTI; NTIS		DE94783394	
FVU-FU–					
93-9	19:27871	OSTI; NTIS		DE94783392	
FZR–					
34(prepr.)	19:28649	OSTI; NTIS (US Sales Only); INIS		DE94789720	
37(prepr.)	19:28760	OSTI; NTIS (US Sales Only); INIS		DE94789721	
38(prepr.)	19:28306	OSTI; NTIS (US Sales Only); INIS		DE94789740	
42(prepr.)	19:28577	OSTI; NTIS (US Sales Only); INIS		DE94789618	
GA-A–					
21347	19:28821	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94015853	MF-426; MF-427
21466	19:28822	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94015860	MF-420
21523	19:28823	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94015858	MF-426
21679	19:28864	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94015720	MF-422
21705	19:28865	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94016521	MF-421
21737	19:28824	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94015719	MF-420
GANIL-P–					
92-11	19:28721	OSTI; NTIS (US Sales Only); INIS		DE94633321	
92-12	19:28722	OSTI; NTIS (US Sales Only); INIS		DE94633306	
93-29	19:28686	OSTI; NTIS (US Sales Only); INIS		DE94633239	
93-30	19:28687	OSTI; NTIS (US Sales Only); INIS		DE94633252	
93-31	19:28704	OSTI; NTIS (US Sales Only); INIS		DE94633281	
93-32	19:28688	OSTI; NTIS (US Sales Only); INIS		DE94633240	
94-01	19:28689	OSTI; NTIS (US Sales Only); INIS		DE94633241	
94-02	19:28690	OSTI; NTIS (US Sales Only); INIS		DE94633242	

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GANIL-P–					
94-03	19:28141	OSTI; NTIS (US Sales Only); INIS		DE94632519	
GSI–					
93-36(prepr.)	19:28217	OSTI; NTIS (US Sales Only); INIS		DE94787008	
94-23(prepr.)	19:28691	OSTI; NTIS (US Sales Only); INIS		DE94789758	
94-24(prepr.)	19:28218	OSTI; NTIS (US Sales Only); INIS		DE94789759	
HAN–					
93855-Rpt.5	19:27270	OSTI; NTIS; GPO Dep.	E 1.99:	DE94015450	MF-500
HD-THEP–					
94-7	19:28604	*See* DESY–94-054			
HEP-LAT–					
9403024	19:28603	*See* DESY–94-046			
HEP-PH–					
9402314	19:28630	*See* DESY–94-020			
9403301	19:28607	*See* DESY–94-034			
9403386	19:28608	*See* DESY–94-036			
9404257	19:28668	*See* DESY–94-061			
HEP-TH–					
9402121	19:28575	*See* DESY–94-018			
9403158	19:28604	*See* DESY–94-054			
9405025	19:28598	*See* BONN-TH–94-04			
HLW-OVP–					
94-0005	19:27362	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94016435	MF-940
HMI-B–					
512	19:28345	OSTI; NTIS (US Sales Only); INIS		DE94789625	
HU-Berlin-IEP–					
94/4	19:28612	*See* DESY–94-067			
HW–					
57168-F	19:27698	OSTI; NTIS; GPO Dep.	E 1.99:	DE94015428	MF-520
57168-G	19:27699	OSTI; NTIS; GPO Dep.	E 1.99:	DE94017016	MF-500
58485	19:28017	OSTI; NTIS; GPO Dep.	E 1.99:	DE94015962	MF-500
58715	19:27668	OSTI; NTIS; GPO Dep.	E 1.99:	DE94017231	MF-500
58817	19:28723	OSTI; NTIS; GPO Dep.	E 1.99:	DE94015971	MF-500
58946	19:27700	OSTI; NTIS; GPO Dep.	E 1.99:	DE94015697	MF-520
60039	19:27701	OSTI; NTIS; GPO Dep.	E 1.99:	DE94015693	MF-500
60233-B	19:27674	OSTI; NTIS; GPO Dep.	E 1.99:	DE94016257	MF-500
60379	19:27675	OSTI; NTIS; GPO Dep.	E 1.99:	DE94016268	MF-520
60439	19:27702	OSTI; NTIS; GPO Dep.	E 1.99:	DE94015676	MF-500
60520	19:27703	OSTI; NTIS; GPO Dep.	E 1.99:	DE94015699	MF-500
60810	19:27704	OSTI; NTIS; GPO Dep.	E 1.99:	DE94016403	MF-520
61767	19:27705	OSTI; NTIS; GPO Dep.	E 1.99:	DE94015691	MF-520
61849	19:27769	OSTI; NTIS; GPO Dep.	E 1.99:	DE94016395	MF-520
61928	19:27706	OSTI; NTIS; GPO Dep.	E 1.99:	DE94016397	MF-520
61955	19:27707	OSTI; NTIS; GPO Dep.	E 1.99:	DE94016274	MF-520
61995	19:27708	OSTI; NTIS; GPO Dep.	E 1.99:	DE94015967	MF-500
62651-1	19:27709	OSTI; NTIS; GPO Dep.	E 1.99:	DE94016267	MF-500
62755	19:27669	OSTI; NTIS; GPO Dep.	E 1.99:	DE94016265	MF-500
62816	19:27676	OSTI; NTIS; GPO Dep.	E 1.99:	DE94016262	MF-500
64793-RD	19:27710	OSTI; NTIS; GPO Dep.	E 1.99:	DE94016401	MF-500
67754	19:27662	OSTI; NTIS; GPO Dep.	E 1.99:	DE94017232	MF-500
67841	19:27968	OSTI; NTIS; GPO Dep.	E 1.99:	DE94016272	MF-500
71233	19:27711	OSTI; NTIS; GPO Dep.	E 1.99:	DE94015219	MF-520
72371	19:27712	OSTI; NTIS; GPO Dep.	E 1.99:	DE94010490	MF-500
72901	19:27897	OSTI; NTIS; GPO Dep.	E 1.99:	DE94015966	MF-500
74096	19:27271	OSTI; NTIS; GPO Dep.	E 1.99:	DE94015979	MF-500
74305	19:27713	OSTI; NTIS; GPO Dep.	E 1.99:	DE94016277	MF-520
75942	19:28002	OSTI; NTIS; GPO Dep.	E 1.99:	DE94015970	MF-500
79734	19:27714	OSTI; NTIS; GPO Dep.	E 1.99:	DE94016399	MF-520
79808	19:27715	OSTI; NTIS; GPO Dep.	E 1.99:	DE94016400	MF-500
82789	19:27716	OSTI; NTIS; GPO Dep.	E 1.99:	DE94016438	MF-500
82977-RD-4	19:27717	OSTI; NTIS; GPO Dep.	E 1.99:	DE94015963	MF-500
83318	19:27718	OSTI; NTIS; GPO Dep.	E 1.99:	DE94017242	MF-500
83367	19:27719	OSTI; NTIS; GPO Dep.	E 1.99:	DE94017234	MF-500
84001	19:27363	OSTI; NTIS; GPO Dep.	E 1.99:	DE94017032	MF-500
84427	19:27663	OSTI; NTIS; GPO Dep.	E 1.99:	DE94017235	MF-500
HWN–					
1697	19:27720	OSTI; NTIS; GPO Dep.	E 1.99:	DE94016504	MF-500
IAE–					
0126.	19:27661	*See* CNIC–00795			
IAEA-TECDOC–					
749	19:27645	OSTI; NTIS (US Sales Only); INIS		DE94632659	

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IFSR–					
665	19:28638	*See* DOE/ET/53088–665			
IKE–					
6-188	19:28050	OSTI; NTIS (US Sales Only); INIS		DE94785957	
INIS-JP–					
024	19:28891	OSTI; NTIS; INIS		DE94785275	
INIS-RU–					
377	19:28779	OSTI; NTIS (US Sales Only); INIS		DE94631501	
INIS-mf–					
14277	19:27898	OSTI; NTIS; INIS		DE94789656	
14293	19:27928	OSTI; NTIS (US Sales Only); INIS		DE94787001	
15003	19:27996	OSTI; NTIS (US Sales Only); INIS		DE94790576	
15007	19:27218	OSTI; NTIS (US Sales Only); INIS		DE94790656	
INS–					
1024	19:28000	OSTI; NTIS; INIS		DE94785270	
INS-J–					
177	19:28670	OSTI; NTIS; INIS		DE94785267	
IPNO-DRE–					
91-28	19:28692	OSTI; NTIS (US Sales Only); INIS		DE94633243	
91-31	19:28724	OSTI; NTIS (US Sales Only); INIS		DE94633322	
91-34	19:28725	OSTI; NTIS (US Sales Only); INIS		DE94633323	
91-36	19:28650	OSTI; NTIS (US Sales Only); INIS		DE94633187	
91-37	19:28726	OSTI; NTIS (US Sales Only); INIS		DE94633324	
92-02	19:28727	OSTI; NTIS (US Sales Only); INIS		DE94633314	
92-03	19:28728	OSTI; NTIS (US Sales Only); INIS		DE94633325	
92-07	19:28700	OSTI; NTIS (US Sales Only); INIS		DE94633275	
94-01.	19:28689	*See* GANIL-P–94-01			
IPNO-TH–					
90-28	19:28693	OSTI; NTIS (US Sales Only); INIS		DE94633253	
91-53	19:28651	OSTI; NTIS (US Sales Only); INIS		DE94633188	
91-56	19:28615	OSTI; NTIS (US Sales Only); INIS		DE94633135	
91-59	19:28694	OSTI; NTIS (US Sales Only); INIS		DE94633244	
91-60	19:28695	OSTI; NTIS (US Sales Only); INIS		DE94633245	
91-63	19:28729	OSTI; NTIS (US Sales Only); INIS		DE94633326	
91-75	19:28616	OSTI; NTIS (US Sales Only); INIS		DE94633136	
91-88	19:28696	OSTI; NTIS (US Sales Only); INIS		DE94633254	
91-92	19:28671	OSTI; NTIS (US Sales Only); INIS		DE94633231	
91-96	19:28672	OSTI; NTIS (US Sales Only); INIS		DE94633232	
91-97	19:28652	OSTI; NTIS (US Sales Only); INIS		DE94633189	
91-98	19:28697	OSTI; NTIS (US Sales Only); INIS		DE94633255	
92-05	19:28705	OSTI; NTIS (US Sales Only); INIS		DE94633282	
92-15	19:28617	OSTI; NTIS (US Sales Only); INIS		DE94633137	
92-17	19:28578	OSTI; NTIS (US Sales Only); INIS		DE94632965	
92-22	19:28673	OSTI; NTIS (US Sales Only); INIS		DE94633221	
IPP–					
1/262	19:28825	OSTI; NTIS (US Sales Only); INIS		DE94790628	
1/271	19:28826	OSTI; NTIS (US Sales Only); INIS		DE94790644	
2/318	19:28827	OSTI; NTIS (US Sales Only); INIS		DE94790629	
4/258	19:28828	OSTI; NTIS (US Sales Only); INIS		DE94790645	
6/315	19:28829	OSTI; NTIS (US Sales Only); INIS		DE94790664	
6/321	19:28798	OSTI; NTIS (US Sales Only); INIS		DE94789719	
ISPO–					
367	19:27981	*See* ORNL/TM–12776			
ITP-UH–					
01/94	19:28607	*See* DESY–94-034			
IYaF–					
93-27	19:28278	OSTI; NTIS (US Sales Only); INIS		DE94632572	
93-52.	19:28626	*See* BUDKERINP–93-52			
93-59.	19:28289	*See* BUDKERINP–93-59			
93-70	19:28830	OSTI; NTIS (US Sales Only); INIS		DE94633377	
93-72.	19:28165	*See* BUDKERINP–93-72			
93-78	19:28279	OSTI; NTIS (US Sales Only); INIS		DE94632573	
93-79	19:28280	OSTI; NTIS (US Sales Only); INIS		DE94632574	
93-80.	19:28767	*See* BUDKERINP–93-80			
93-89	19:28831	OSTI; NTIS (US Sales Only); INIS		DE94633373	
93-90.	19:28277	*See* BUDKERINP–93-90			
JAERI–					
1331	19:27276	OSTI; NTIS; INIS		DE94785273	
JAERI-M–					
94-001	19:27929	OSTI; NTIS; INIS		DE94785101	
94-012	19:27563	OSTI; NTIS; INIS		DE94785197	

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94-017	19:28892	OSTI; NTIS; INIS		DE94785277	
94-022	19:27899	OSTI; NTIS; INIS		DE94785198	
94-027	19:27364	OSTI; NTIS; INIS		DE94785278	
94-048	19:28866	OSTI; NTIS; INIS		DE94785266	
94-061	19:27267	OSTI; NTIS; INIS		DE94785243	
94-065	19:28491	OSTI; NTIS; INIS		DE94785242	
94-067	19:27365	OSTI; NTIS; INIS		DE94785241	
94-069	19:27646	OSTI; NTIS; INIS		DE94785272	
94-072	19:28867	OSTI; NTIS; INIS		DE94785265	
JINR–					
13-91-391	19:28308	OSTI; NTIS (US Sales Only); INIS		DE94632795	
13-91-423	19:28309	OSTI; NTIS (US Sales Only); INIS		DE94632796	
JINR-E–					
1-91-412	19:28310	OSTI; NTIS (US Sales Only); INIS		DE94632792	
4-93-58	19:28698	OSTI; NTIS (US Sales Only); INIS		DE94632190	
9-92-259	19:28281	OSTI; NTIS (US Sales Only); INIS		DE94632575	
JINR-R–					
10-91-419	19:28311	OSTI; NTIS (US Sales Only); INIS		DE94632793	
13-91-299	19:28312	OSTI; NTIS (US Sales Only); INIS		DE94632794	
16-92-190	19:28554	OSTI; NTIS (US Sales Only); INIS		DE94632374	
K/TCD–					
1111	19:28492	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94016531	MF-902
KAPL–					
4763	19:27900	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94015362	PC-504
4766	19:27901	OSTI; NTIS; GPO Dep.	E 1.99:	DE94015361	PC-504
4777	19:27949	OSTI; NTIS; GPO Dep.	E 1.99:	DE94015360	PC-504
4782	19:27902	OSTI; NTIS; GPO Dep.	E 1.99:	DE94015359	PC-506
KCP–					
613-5272	19:28051	OSTI; NTIS; GPO Dep.	E 1.99:	DE94015861	MF-706
613-5273	19:28074	OSTI; NTIS; GPO Dep.	E 1.99:	DE94015862	MF-706
613-5288	19:28527	OSTI; NTIS; GPO Dep.	E 1.99:	DE94015177	MF-705
613-5303	19:27863	OSTI; NTIS; GPO Dep.	E 1.99:	DE94015863	MF-706
613-5318	19:28075	OSTI; NTIS; GPO Dep.	E 1.99:	DE94015864	MF-706
613-5368	19:28360	OSTI; NTIS; GPO Dep.	E 1.99:	DE94015865	MF-706
613-5384	19:28388	OSTI; NTIS; GPO Dep.	E 1.99:	DE94015866	MF-706
613-5431	19:28389	OSTI; NTIS; GPO Dep.	E 1.99:	DE94015867	MF-706
613-5433	19:27950	OSTI; NTIS; GPO Dep.	E 1.99:	DE94015868	MF-706
KEK-PROC–					
93-22	19:28653	OSTI; NTIS; INIS		DE94785274	
KFK–					
5298	19:28868	OSTI; NTIS (US Sales Only); INIS		DE94785971	
5300	19:27821	OSTI; NTIS (US Sales Only); INIS		DE94786624	
5307	19:27656	OSTI; NTIS (US Sales Only); INIS		DE94789739	
5309	19:27903	OSTI; NTIS (US Sales Only); INIS		DE94789624	
5325	19:28893	OSTI; NTIS (US Sales Only); INIS		DE94785972	
KFKI–					
1993-20/E	19:28775	OSTI; NTIS (US Sales Only); INIS		DE94633439	
LA–					
1-93-013	19:28376	*See* LA-SUB–93-195			
12765	19:27972	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94015172	MF-732
12773	19:28869	OSTI; NTIS; GPO Dep.	E 1.99:	DE94015171	MF-741; MF-700
12786	19:27366	OSTI; NTIS; GPO Dep.	E 1.99:	DE94013645	MF-1414
12793-MS	19:27367	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94017064	MF-721
12795-MS	19:27459	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94015564	MF-908; MF-902
12811-MS	19:28003	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94015718	MF-504; MF-520
12818-MS	19:28555	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94016442	MF-902; MF-402; MF-802
12827-M	19:27664	OSTI; NTIS; GPO Dep.	E 1.99:	DE94016577	MF-714
LA-SUB–					
93-195	19:28376	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE94015426	
93-312	19:28394	OSTI; NTIS; GPO Dep.	E 1.99:	DE94015421	MF-903
94-103	19:28493	OSTI; NTIS; GPO Dep.	E 1.99:	DE94016574	MF-900
94-106	19:27973	OSTI; NTIS; GPO Dep.	E 1.99:	DE94016576	MF-701
94-108	19:28033	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94016571	MF-714
94-109	19:27370	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94017065	MF-802
94-112	19:28585	OSTI; NTIS; GPO Dep.	E 1.99:	DE94016567	MF-700

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
94-118	19:28325	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94016569	MF-700
94-17	19:27368	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94015420	MF-900
94-43	19:28395	OSTI; NTIS; GPO Dep.	E 1.99:	DE94017050	MF-703
94-67	19:27772	OSTI; NTIS (documentation only); ESTSC (complete software package), P.O. Box 1020, Oak Ridge, TN 37831-1020; INIS; GPO Dep.	E 1.99:	DE94017051	MF-731
94-82	19:27742	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94015416	MF-731
94-83	19:27790	OSTI; NTIS; GPO Dep.	E 1.99:	DE94015417	
94-85	19:27773	OSTI; NTIS; GPO Dep.	E 1.99:	DE94015418	MF-731
94-88	19:27495	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94015419	MF-902; MF-940
94-89	19:27877	OSTI; NTIS; GPO Dep.	E 1.99:	DE94015424	MF-706
94-92	19:27369	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94017052	MF-814
94-98	19:28377	OSTI; NTIS; GPO Dep.	E 1.99:	DE94016572	
94-99	19:28757	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94016573	MF-700
LA-UR–					
93-4305	19:27566	OSTI; NTIS; GPO Dep.	E 1.99:	DE94004979	MF-700
93-4416	19:28569	OSTI; NTIS; GPO Dep.	E 1.99:	DE94004560	MF-703
94-1250	19:28936	OSTI; NTIS; GPO Dep.	E 1.99:	DE94011703	MF-405
94-1310	19:28361	OSTI; NTIS; GPO Dep.	E 1.99:	DE94011719	MF-706
94-1311	19:28348	OSTI; NTIS; GPO Dep.	E 1.99:	DE94011721	MF-706
94-1357	19:27244	OSTI; NTIS; GPO Dep.	E 1.99:	DE94014725	MF-703
94-1429	19:27371	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94014724	MF-414; MF-721
94-1434	19:28378	OSTI; NTIS; GPO Dep.	E 1.99:	DE94014719	
94-1446	19:28532	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94014718	MF-910; MF-908
94-1461	19:27372	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94011710	MF-721
94-1581	19:28731	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94014803	MF-700
94-1587	19:28586	OSTI; NTIS; GPO Dep.	E 1.99:	DE94014802	MF-700
94-1588	19:28587	OSTI; NTIS; GPO Dep.	E 1.99:	DE94014801	
94-1591	19:28326	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94014799	MF-413
94-1592	19:28732	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94014800	MF-413
94-1594	19:28733	OSTI; NTIS; INIS; GPO Dep	E 1.99:	DE94014797	MF-413
94-1602	19:28937	OSTI; NTIS; GPO Dep.	E 1.99:	DE94014796	MF-705
94-1605	19:28832	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94014819	MF-424; MF-413
94-1606	19:27620	OSTI; NTIS; GPO Dep.	E 1.99:	DE94014818	MF-1241
94-1610	19:28588	OSTI; NTIS; GPO Dep.	E 1.99:	DE94014817	MF-700
94-1614	19:28794	OSTI; NTIS; GPO Dep.	E 1.99:	DE94014808	MF-1263
94-1616	19:28589	OSTI; NTIS; GPO Dep.	E 1.99:	DE94014809	
94-1668	19:28570	OSTI; NTIS; GPO Dep.	E 1.99:	DE94013084	MF-703
94-1697	19:27904	OSTI; NTIS; GPO Dep.	E 1.99:	DE94014810	MF-704
94-1791	19:28885	OSTI; NTIS; GPO Dep.	E 1.99:	DE94014258	MF-900
94-1907	19:28734	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94014458	MF-413
94-1949	19:28579	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94014436	MF-414
94-2019	19:27373	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94014291	MF-940
94-2080	19:27616	OSTI; NTIS; GPO Dep.	E 1.99:	DE94014468	
94-2107	19:28870	OSTI; NTIS; GPO Dep.	E 1.99:	DE94014429	MF-700
94-2128	19:28938	OSTI; NTIS; GPO Dep.	E 1.99:	DE94014460	MF-705
94-2129	19:28590	OSTI; NTIS; GPO Dep.	E 1.99:	DE94014461	MF-700
94-2203	19:28327	OSTI; NTIS; GPO Dep.	E 1.99:	DE94016083	MF-706
94-2236	19:27536	OSTI; NTIS; GPO Dep.	E 1.99:	DE94014480	MF-700
94-2245	19:27374	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94016080	MF-814
94-2249	19:28115	OSTI; NTIS; GPO Dep.	E 1.99:	DE94016079	MF-700
94-2253	19:27537	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94016077	MF-700
94-2268	19:28871	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94016073	MF-700
94-2271	19:27538	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94016074	MF-900
94-2272	19:27905	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94016072	MF-410; MF-404
94-2292	19:27539	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94016068	MF-700
94-2293	19:27540	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94016067	MF-700
94-2307	19:28591	OSTI; NTIS; GPO Dep.	E 1.99:	DE94016064	
94-2312	19:27541	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94016063	MF-700
94-2313	19:28328	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94016061	MF-900
94-2320	19:27542	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94016058	MF-700
94-2327	19:28675	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94016057	MF-414
94-2374	19:27543	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94016157	MF-700
94-2375	19:27544	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94016295	MF-700

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
94-2385	19:27883	OSTI; NTIS; GPO Dep.	E 1.99:	DE94016283	MF-1501
94-2388	19:28786	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94016284	MF-700
94-2395	19:27545	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94016286	MF-706
94-2400	19:27277	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94016288	MF-721
94-2408	19:27272	OSTI; NTIS; GPO Dep.	E 1.99:	DE94016289	
94-2417	19:27546	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94016290	MF-700
94-2418	19:28329	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94016292	MF-940
94-2420	19:28735	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94016293	MF-413
94-2430	19:28839	*See* PPPL-CFP–3101			
94-2437	19:27906	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94016281	MF-704
94-2438	19:28833	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94016184	MF-700; MF-706
94-2439	19:28116	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94016183	MF-700
94-2441	19:27547	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94016177	MF-721
94-2444	19:27548	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94016205	MF-700
94-2446	19:27549	OSTI; NTIS; GPO Dep.	E 1.99:	DE94016208	MF-700
94-2447	19:27550	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94016209	MF-700
94-2474	19:27375	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94016167	MF-721
94-2475	19:27551	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94016169	MF-721
94-2477	19:27974	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94016195	MF-700
94-2482	19:27552	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94016092	MF-700
94-2483	19:28117	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94016093	
94-2502	19:28330	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94016087	MF-906
94-2527	19:28494	OSTI; NTIS; GPO Dep.	E 1.99:	DE94016160	
94-2531	19:27553	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94016213	MF-700
94-2532	19:27376	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94016214	MF-414
94-2562	19:28362	OSTI; NTIS; GPO Dep.	E 1.99:	DE94016095	
94-2563	19:28872	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94016094	MF-414
94-2574	19:28776	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94016599	MF-414
94-2575	19:27907	OSTI; NTIS; GPO Dep.	E 1.99:	DE94016100	MF-404
94-2576	19:28076	OSTI; NTIS; GPO Dep.	E 1.99:	DE94016099	MF-706
94-2581	19:27884	OSTI; NTIS; GPO Dep.	E 1.99:	DE94016202	MF-900
94-2612	19:28592	OSTI; NTIS; GPO Dep.	E 1.99:	DE94016197	MF-700
94-2627	19:27908	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94016194	MF-711
94-575	19:28934	OSTI; NTIS; GPO Dep.	E 1.99:	DE94007575	MF-705
94-895	19:28935	OSTI; NTIS; GPO Dep.	E 1.99:	DE94009364	MF-705
LAL–					
93-60	19:28674	OSTI; NTIS (US Sales Only); INIS		DE94633216	
93-64	19:28618	OSTI; NTIS (US Sales Only); INIS		DE94633127	
93-66	19:28654	OSTI; NTIS (US Sales Only); INIS		DE94633180	
LAL-RT–					
92-01	19:28582	OSTI; NTIS (US Sales Only); INIS		DE94633033	
93-14	19:28242	OSTI; NTIS (US Sales Only); INIS		DE94632546	
LBL–					
33192	19:27839	OSTI; NTIS; GPO Dep.	E 1.99:	DE94014962	MF-1600
33906	19:27840	OSTI; NTIS; GPO Dep.	E 1.99:	DE94014968	MF-1600
34271	19:27841	OSTI; NTIS; GPO Dep.	E 1.99:	DE94014960	MF-1600
34581	19:28495	OSTI; NTIS; GPO Dep.	E 1.99:	DE94011007	MF-800
34715	19:27842	OSTI; NTIS; GPO Dep.	E 1.99:	DE94014915	MF-1600
34717	19:27843	OSTI; NTIS; GPO Dep.	E 1.99:	DE94014970	MF-1600
34810	19:27951	OSTI; NTIS; GPO Dep.	E 1.99:	DE94016876	MF-404
35022	19:28795	OSTI; NTIS; GPO Dep.	E 1.99:	DE94016873	MF-404
35162	19:27997	OSTI; NTIS; GPO Dep.	E 1.99:	DE94016869	MF-404; MF-401
35253	19:27844	OSTI; NTIS; GPO Dep.	E 1.99:	DE94014925	MF-1600
35256	19:27845	OSTI; NTIS; GPO Dep.	E 1.99:	DE94014911	MF-1600
35282	19:28939	OSTI; NTIS; GPO Dep.	E 1.99:	DE94011365	MF-405
35382-Rev.	19:27846	OSTI; NTIS; GPO Dep.	E 1.99:	DE94014969	MF-1600
35435	19:28331	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94014927	MF-414; MF-404
35459	19:28243	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94014963	MF-414
35525	19:28593	OSTI; NTIS; GPO Dep.	E 1.99:	DE94014928	MF-413

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35530	19:28619	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94014917	MF-414
35559	19:28008	OSTI; NTIS; GPO Dep.	E 1.99:	DE94016868	MF-400
35568	19:28676	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94016863	MF-413
35626	19:27952	OSTI; NTIS; GPO Dep.	E 1.99:	DE94014913	MF-404; MF-1425
35660	19:27930	OSTI; NTIS; GPO Dep.	E 1.99:	DE94014914	MF-400
35669	19:28046	OSTI; NTIS; GPO Dep.	E 1.99:	DE94014971	MF-405
35671	19:28796	OSTI; NTIS; GPO Dep.	E 1.99:	DE94016875	MF-404
35707	19:28047	OSTI; NTIS; GPO Dep.	E 1.99:	DE94014931	MF-405
35715	19:27975	OSTI; NTIS; GPO Dep.	E 1.99:	DE94016217	MF-413
35909	19:27377	OSTI; NTIS; GPO Dep.	E 1.99:	DE94016218	MF-800
LITH-IFM-R–					
206	19:28464	OSTI; NTIS		DE94783402	
207	19:28465	OSTI; NTIS		DE94783403	
LPN–					
93-04	19:28736	OSTI; NTIS (US Sales Only); INIS		DE94633328	
93-18	19:28737	OSTI; NTIS (US Sales Only); INIS		DE94633315	
LPNHE–					
92-01	19:28677	OSTI; NTIS (US Sales Only); INIS		DE94633217	
92-03	19:28620	OSTI; NTIS (US Sales Only); INIS		DE94633138	
93-07	19:28655	OSTI; NTIS (US Sales Only); INIS		DE94633181	
LUNBDS-NBGK–					
94-31	19:28496	OSTI; NTIS; INIS		DE94632206	
LUTFD2-TFFF–					
0039-1-160	19:28772	OSTI; NTIS; INIS		DE94631459	
LUTKDH-TKKA–					
1003-1-98-94	19:27572	OSTI; NTIS		DE94783390	
1004-1-45-94	19:27573	OSTI; NTIS		DE94783391	
LUTKDH-TKMB–					
1020	19:27574	OSTI; NTIS		DE94783400	
LUTVDG-TVTG–					
3038	19:27623	*See* NUTEK-GT–94-2			
MPI-PhE–					
93-34	19:28332	OSTI; NTIS (US Sales Only); INIS		DE94786364	
94-01	19:28333	OSTI; NTIS (US Sales Only); INIS		DE94786365	
94-10	19:28785	OSTI; NTIS (US Sales Only); INIS		DE94789666	
MT-CWR–					
094-013	19:27889	*See* DOE/ER/45308–7			
NASA/CR–					
195367	19:27876	*See* DOE/NASA–0336-4			
NEA-NSC-DOC–					
93-25	19:27641	OSTI; NTIS (US Sales Only); INIS		DE94632653	
NEI-DK–					
1567	19:27378	OSTI; NTIS; INIS		DE94632826	
1577	19:27575	OSTI; NTIS		DE94783298	
1578	19:28466	OSTI; NTIS		DE94783292	
1579	19:27626	OSTI; NTIS		DE94783297	
1580	19:27594	OSTI; NTIS; INIS		DE94783285	
1584	19:27576	OSTI; NTIS		DE94783313	
1585	19:27624	OSTI; NTIS; INIS		DE94783307	
1586	19:27799	OSTI; NTIS		DE94783310	
1587	19:27800	OSTI; NTIS		DE94783311	
1588	19:27801	OSTI; NTIS		DE94783312	
1589	19:27808	OSTI; NTIS		DE94783302	
NGU–					
93-121	19:28519	OSTI; NTIS; INIS		DE94632215	
NIKHEF-H–					
94-09	19:28656	OSTI; NTIS; INIS		DE94789643	
NREL/CP–					
413-7033	19:27596	OSTI; NTIS; GPO Dep.	E 1.99:	DE94011828	MF-1250
NREL/TP–					
411-6855	19:27597	OSTI; NTIS; GPO Dep.	E 1.99:	DE94011840	MF-1262
411-6864	19:27598	OSTI; NTIS; GPO Dep.	E 1.99:	DE94011842	MF-1262
413-6853	19:27599	OSTI; NTIS; GPO Dep.	E 1.99:	DE94011830	MF-1263
425-6161	19:27878	OSTI; NTIS; GPO Dep.	E 1.99:	DE94011851	MF-1501

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NREL/TP–					
425-6355	19:27257	OSTI; NTIS; GPO Dep.	E 1.99:	DE94011868	MF-1504
430-6078	19:27872	OSTI; NTIS; GPO Dep.	E 1.99:	DE94011805	MF-1414
440-6628	19:27625	OSTI; NTIS; GPO Dep.	E 1.99:	DE94011853	MF-1210
441-7044	19:27627	OSTI; NTIS; GPO Dep.	E 1.99:	DE94011854	MF-1211
451-6491	19:27600	OSTI; NTIS; GPO Dep.	E 1.99:	DE94011837	MF-1262
451-6862	19:27601	OSTI; NTIS; GPO Dep.	E 1.99:	DE94011846	MF-1263
451-7045	19:27602	OSTI; NTIS; GPO Dep.	E 1.99:	DE94011847	MF-1262
451-7047	19:27603	OSTI; NTIS; GPO Dep.	E 1.99:	DE94011849	MF-1263
463-5607	19:27592	OSTI; NTIS; GPO Dep.	E 1.99:	DE93018229	MF-1300
NUREG–					
0540-Vol.16-No.5	19:27637	OSTI; NTIS; INIS; GPO		TI94015396	
0711	19:27658	OSTI; NTIS; INIS; GPO		TI94016710	
0837-Vol.14-No.1	19:27460	OSTI; NTIS; INIS; GPO		TI94015241	
0940-Vol.13-No.1-Pt.1	19:27659	OSTI; NTIS; GPO; INIS		TI94015135	
1307-Rev.4	19:27379	OSTI; NTIS; INIS; GPO		TI94017142	
1426-Vol.2	19:27909	OSTI; NTIS; INIS; GPO		TI94016727	
1502	19:27655	OSTI; NTIS; INIS; GPO		TI94016717	
NUREG/CR–					
4667-Vol.17	19:27642	OSTI; NTIS; INIS		TI94014862	
5128-Rev.1	19:27665	OSTI; NTIS; GPO; INIS		TI94015006	
5908-Vol.1	19:27677	OSTI; NTIS; INIS; GPO		TI94017059	
5908-Vol.2	19:27678	OSTI; NTIS; INIS; GPO		TI94017060	
6116-Vol.5	19:28009	OSTI; NTIS; INIS; GPO		TI94016524	
6116-Vol.7	19:27774	OSTI; NTIS; INIS; GPO		TI94016684	
6121	19:27643	OSTI; NTIS; INIS; GPO		TI94017139	
6128	19:27775	OSTI; NTIS; INIS; GPO		TI94016707	
6143-Vol.2-Pt.1A	19:27776	OSTI; NTIS; INIS; GPO		TI94015869	
6143-Vol.2-Pt.4	19:27647	OSTI; NTIS; GPO; INIS		TI94016049	
6144-Vol.2-Pt.3B	19:27648	OSTI; NTIS; INIS; GPO		TI94016242	
6144-Vol.2-Pt.4	19:27649	OSTI; NTIS; INIS; GPO		TI94016243	
6144-Vol.2-Pt.5	19:27650	OSTI; NTIS; INIS; GPO		TI94016244	
6152	19:27777	OSTI; NTIS; INIS; GPO		TI94015005	
6212	19:27496	OSTI; NTIS; INIS; GPO		TI94015399	
NUREG/GR–					
0013	19:28052	OSTI; NTIS; INIS; GPO		TI94015174	
NUTEK-FJV–					
94-1	19:28467	OSTI; NTIS		DE94783404	
NUTEK-GT–					
94-1	19:27619	OSTI; NTIS		DE94783405	
94-2	19:27623	OSTI; NTIS		DE94783406	
NUTEK-NYEL–					
94-1	19:28797	OSTI; NTIS		DE94783407	
NUTEK-VIND–					
94-1	19:27628	OSTI; NTIS		DE94783408	
NYSERDA–					
94-9	19:27580	OSTI; NYSERDA, Two Rockefeller Plaza, Albany, NY 12223 (United States)		TI94016245	
OAEP–					
1-110	19:28539	OSTI; NTIS (US Sales Only); INIS		DE94632340	
1-113	19:28556	OSTI; NTIS (US Sales Only); INIS		DE94632375	
1-114	19:28540	OSTI; NTIS (US Sales Only); INIS		DE94632341	
1-115	19:28541	OSTI; NTIS (US Sales Only); INIS		DE94632342	
1-118	19:28542	OSTI; NTIS (US Sales Only); INIS		DE94632343	
1-126	19:27976	OSTI; NTIS (US Sales Only); INIS		DE94631502	
1-127	19:27977	OSTI; NTIS (US Sales Only); INIS		DE94631503	
1-128	19:27998	OSTI; NTIS (US Sales Only); INIS		DE94631534	
1-134	19:27978	OSTI; NTIS (US Sales Only); INIS		DE94631504	
1-141	19:27979	OSTI; NTIS (US Sales Only); INIS		DE94631505	
1-147	19:28557	OSTI; NTIS (US Sales Only); INIS		DE94632376	
2-1	19:28558	OSTI; NTIS (US Sales Only); INIS		DE94632377	
91	19:27980	OSTI; NTIS (US Sales Only); INIS		DE94631500	

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
ORNL–					
6714	19:28799	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94015516	PC-420
6775/V1	19:27835	OSTI; NTIS; GPO Dep.	E 1.99:	DE94015935	MF-1210; MF-1250; MF-1300
6784	19:27461	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94015515	PC-402
6798	19:27858	OSTI; NTIS; GPO Dep.	E 1.99:	DE94015723	MF-1500
6813	19:27802	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94016593	MF-400
ORNL/CON–					
363	19:27847	OSTI; NTIS; GPO Dep.	E 1.99:	DE94015961	MF-1600
375	19:27873	OSTI; NTIS; GPO Dep.	E 1.99:	DE94014956	MF-1600
380	19:27848	OSTI; NTIS; GPO Dep.	E 1.99:	DE94015527	MF-1600
ORNL/ER–					
191-D2	19:27477	*See* DOE/OR–01-1194-D2			
202	19:28520	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94015939	MF-902
221-D1	19:27478	*See* DOE/OR–01-1252-D1			
ORNL/M–					
3026	19:27826	OSTI; NTIS; GPO Dep.	E 1.99:	DE94015633	MF-630
3271/R2	19:27827	OSTI; NTIS; GPO Dep.	E 1.99:	DE94015251	MF-630
3609	19:27336	*See* DOE/MWIP–20			
3691	19:27337	*See* DOE/MWIP–29			
ORNL/Sub–					
91-SL794	19:27849	OSTI; NTIS; GPO Dep.	E 1.99:	DE94016782	MF-1600
ORNL/TM–					
12507	19:28940	OSTI; NTIS; GPO Dep.	E 1.99:	DE94015458	MF-405
12646	19:27931	OSTI; NTIS; GPO Dep.	E 1.99:	DE94015851	MF-1425; MF-1406; MF-704; MF-404
12710	19:28034	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94015635	MF-902; MF-906
12721	19:28834	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94015514	PC-427
12749	19:27568	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94016590	MF-506
12757	19:28835	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94015214	PC-426
12759	19:27380	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94015934	MF-902
12763	19:27885	OSTI; NTIS; GPO Dep.	E 1.99:	DE94015528	MF-1425
12764	19:28941	OSTI; NTIS; GPO Dep.	E 1.99:	DE94015457	MF-405
12773	19:27859	OSTI; NTIS; GPO Dep.	E 1.99:	DE94015660	
12775	19:27743	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94014955	MF-400
12776	19:27981	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94017070	
OUP–					
94-07	19:28942	OSTI; NTIS; INIS		DE94632948	
PATENTS-US–					
A7883315	19:28077	OSTI; NTIS; GPO Dep.	E 1.99:	DE94014899	MF-706
A7896762	19:27497	OSTI; NTIS; GPO Dep.	E 1.99:	DE94014891	MF-700
A7897409	19:28334	OSTI; NTIS; GPO Dep.	E 1.99:	DE94014888	MF-506
A7898999	19:28363	OSTI; NTIS; GPO Dep.	E 1.99:	DE94014887	MF-706
A7901289	19:28364	OSTI; NTIS; GPO Dep.	E 1.99:	DE94014886	MF-706
A7905989	19:28035	OSTI; NTIS; GPO Dep.	E 1.99:	DE94014884	MF-706
A7909323	19:28244	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94016142	MF-406
A7909890	19:27879	OSTI; NTIS; GPO Dep.	E 1.99:	DE94016141	MF-1502
A7913095	19:27209	OSTI; NTIS; GPO Dep.	E 1.99:	DE94016135	MF-109
A7914327	19:28118	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94016134	MF-414
A7918095	19:28594	OSTI; NTIS; GPO Dep.	E 1.99:	DE94016132	MF-404
A7920736	19:27860	OSTI; NTIS; GPO Dep.	E 1.99:	DE94016131	MF-406
A7920737	19:27861	OSTI; NTIS; GPO Dep.	E 1.99:	DE94016130	MF-406
A7921780	19:28583	OSTI; NTIS; GPO Dep.	E 1.99:	DE94016128	MF-704
A7923298	19:27932	OSTI; NTIS; GPO Dep.	E 1.99:	DE94016126	MF-706
A7924991	19:28245	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94016125	MF-406

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
A7933145	19:27982	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94016122	MF-706
A7933151	19:27983	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94016121	MF-706
A7933152	19:27570	OSTI; NTIS; GPO Dep.	E 1.99:	DE94016120	MF-706
A7933154	19:28036	OSTI; NTIS; GPO Dep.	E 1.99:	DE94016118	MF-706
A7933155	19:28335	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94016117	MF-706
A7933642	19:28078	OSTI; NTIS; GPO Dep.	E 1.99:	DE94016116	MF-706
A7934714	19:28533	OSTI; NTIS; GPO Dep.	E 1.99:	DE94016107	MF-406
A7935328	19:27381	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94016106	MF-406
A7935950	19:27498	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94016105	MF-702
A7940409	19:28365	OSTI; NTIS; GPO Dep.	E 1.99:	DE94016104	MF-704
A7941837	19:28336	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94016103	MF-706
A7941838	19:28079	OSTI; NTIS; GPO Dep.	E 1.99:	DE94016102	MF-706
A7942239	19:28372	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94016101	MF-940
PCCF-RI–					
91-09	19:28657	OSTI; NTIS (US Sales Only); INIS		DE94633190	
92-03	19:28738	OSTI; NTIS (US Sales Only); INIS		DE94633329	
PNL–					
8806	19:27296	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94016472	MF-510
8996	19:27382	OSTI; NTIS; GPO Dep.	E 1.99:	DE94014992	MF-900
9412	19:27499	OSTI; NTIS; GPO Dep.	E 1.99:	DE94011138	MF-902
9421	19:27500	OSTI; NTIS; GPO Dep.	E 1.99:	DE94013365	MF-902
9818	19:28399	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94015192	
9820	19:27850	OSTI; NTIS; GPO Dep.	E 1.99:	DE94016811	MF-1600
9872	19:28943	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE94015288	
9873	19:28497	OSTI; NTIS; GPO Dep.	E 1.99:	DE94015942	
9958	19:28346	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94015880	MF-606
9959	19:27383	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94016420	MF-940
9960	19:28521	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94015394	MF-902
9961	19:27501	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94015881	MF-510
9965	19:27273	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94015285	MF-510
9968	19:27803	OSTI; NTIS; GPO Dep.	E 1.99:	DE94016419	MF-900
9976	19:27874	OSTI; NTIS; GPO Dep.	E 1.99:	DE94015882	MF-1600
9980	19:27681	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94015596	MF-603
9982	19:27744	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94016810	MF-520
9983	19:28559	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94015995	MF-507
9984	19:27384	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94016418	MF-940
9991	19:28498	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94015297	
PNL-SA–					
22426	19:27778	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94011681	MF-507
22844	19:27793	OSTI; NTIS; GPO Dep.	E 1.99:	DE94014560	MF-1340
23055	19:27385	OSTI; NTIS; GPO Dep.	E 1.99:	DE94014995	MF-902
23148	19:28499	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94015210	
23186	19:27386	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94014558	MF-940
23225	19:27851	OSTI; NTIS; GPO Dep.	E 1.99:	DE94015199	MF-1600
23384	19:27387	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94015286	MF-940
23454	19:27388	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94015273	MF-940
23487	19:27389	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94015212	MF-940
23488	19:27390	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94014571	MF-901; MF-940
23559	19:28468	OSTI; NTIS; GPO Dep.	E 1.99:	DE94015945	MF-402; MF-406
23679	19:28969	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94014570	MF-902
23736	19:28567	OSTI; NTIS; GPO Dep.	E 1.99:	DE94014493	MF-900
23945	19:27984	OSTI; NTIS; GPO Dep.	E 1.99:	DE94015204	MF-501
23966	19:28396	OSTI; NTIS; GPO Dep.	E 1.99:	DE94015206	MF-703
23990	19:28037	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94014430	MF-506
24065	19:27391	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94014498	MF-940
24153	19:28560	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94015196	MF-407
24165	19:28873	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94015195	MF-424
24175	19:28500	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94014557	MF-402
24192	19:28561	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94015002	MF-607
24197	19:27875	OSTI; NTIS; GPO Dep.	E 1.99:	DE94014996	MF-1600
24206	19:28874	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94015209	MF-423
24210	19:27392	OSTI; NTIS; GPO Dep.	E 1.99:	DE94014437	MF-900
24224	19:27910	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94015202	MF-420
24272	19:28337	OSTI; NTIS; GPO Dep.	E 1.99:	DE94015213	MF-506

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
24287	19:28568	OSTI; NTIS; GPO Dep.	E 1.99:	DE94015200	MF-507
24290	19:27809	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94015197	MF-902
24329	19:27591	OSTI; NTIS; GPO Dep.	E 1.99:	DE94014446	MF-502
24337	19:28528	OSTI; NTIS; GPO Dep.	E 1.99:	DE94014565	MF-408
24365	19:27864	OSTI; NTIS; GPO Dep.	E 1.99:	DE94015001	MF-1400
24419	19:27502	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94015205	MF-902
24432	19:28469	OSTI; NTIS; GPO Dep.	E 1.99:	DE94015207	MF-502; MF-506
24433	19:28875	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94014999	MF-424
24444	19:27814	OSTI; NTIS; GPO Dep.	E 1.99:	DE94015735	MF-406
24486	19:28944	OSTI; NTIS; GPO Dep.	E 1.99:	DE94014993	MF-405
24509	19:28338	OSTI; NTIS; GPO Dep.	E 1.99:	DE94015208	MF-506
24626	19:28470	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94015734	MF-902
PPPL–					
2998	19:28836	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94016411	PC-427
3002	19:28837	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94016412	PC-427
3003	19:28838	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94016413	PC-426
PPPL-CFP–					
3082	19:28876	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94014860	MF-420
3091	19:28877	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94014855	MF-426
3101	19:28839	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94015563	MF-414
3102	19:28840	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94015562	MF-414
PPPL-TH–					
94-1	19:28841	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94016414	PC-427
PSI–					
94-06	19:28048	OSTI; NTIS; INIS		DE94627982	
RAL–					
94-021	19:28630	*See* DESY–94-020			
RFP–					
4728	19:28945	OSTI; NTIS; GPO Dep.	E 1.99:	DE94009982	MF-630
4810	19:27503	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94011163	MF-902
4848	19:27504	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94011229	MF-630
RISO-R–					
734(EN)	19:28773	OSTI; NTIS; INIS		DE94631460	
755(EN)	19:28471	OSTI; NTIS; Also available from Risoe Library, P.O. Box 49, DK-4000 Roskilde, Denmark		DE94783299	
RL-GEN–					
1300-4	19:27745	OSTI; NTIS; GPO Dep.	E 1.99:	DE94015687	MF-500
RL-NRD–					
150-7C	19:27746	OSTI; NTIS; GPO Dep.	E 1.99:	DE94015098	MF-520
266-EX5	19:27747	OSTI; NTIS; GPO Dep.	E 1.99:	DE94015108	MF-520
512	19:27748	OSTI; NTIS; GPO Dep.	E 1.99:	DE94015103	MF-520
RL-REA–					
188	19:27749	OSTI; NTIS; GPO Dep.	E 1.99:	DE94014848	MF-500
2249-D	19:27750	OSTI; NTIS; GPO Dep.	E 1.99:	DE94015682	MF-500
RL-SEP–					
676-Del.	19:27569	OSTI; NTIS; GPO Dep.	E 1.99:	DE94016496	MF-700
939-RD-Del.	19:27564	OSTI; NTIS; GPO Dep.	E 1.99:	DE94016495	MF-700
SAND–					
89-0217	19:28886	OSTI; NTIS; GPO Dep.	E 1.99:	DE94016686	MF-700
91-0501	19:27751	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94016768	MF-520
93-0681	19:27393	OSTI; NTIS; GPO Dep.	E 1.99:	DE94015597	MF-903
93-0848	19:28562	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94016769	MF-520
93-1611C	19:27779	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94007936	
93-2243C	19:28080	OSTI; NTIS; GPO Dep.	E 1.99:	DE94015281	MF-706
93-2440-Vol.2-Pt.1A	19:27776	*See* NUREG/CR–6143-Vol.2-Pt.1A			
93-2440-Vol.2-Pt.4	19:27647	*See* NUREG/CR–6143-Vol.2-Pt.4			
93-2697C	19:27752	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94016553	MF-706
93-2758C	19:27953	OSTI; NTIS; GPO Dep.	E 1.99:	DE94015796	MF-704
93-3813C	19:28878	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94015802	MF-712
93-3838C	19:28246	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94015766	MF-700
93-4031	19:27256	OSTI; NTIS; GPO Dep.	E 1.99:	DE94016146	MF-126
93-4053	19:27609	OSTI; NTIS; GPO Dep.	E 1.99:	DE94015598	MF-1262
94-0007	19:27610	OSTI; NTIS; GPO Dep.	E 1.99:	DE94015599	MF-1301
94-0058C	19:28053	OSTI; NTIS; GPO Dep.	E 1.99:	DE94014142	MF-704; MF-706
94-0083C	19:28054	OSTI; NTIS; GPO Dep.	E 1.99:	DE94014285	MF-700
94-0219	19:27999	OSTI; NTIS; GPO Dep.	E 1.99:	DE94016145	MF-401

SAND–

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
94-0322	19:28472	OSTI; NTIS; GPO Dep.	E 1.99:	DE94013816	MF-902
94-0374C	19:27297	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94016148	MF-714
94-0391	19:28081	OSTI; NTIS; GPO Dep.	E 1.99:	DE94015600	MF-404
94-0481C	19:28038	OSTI; NTIS; GPO Dep.	E 1.99:	DE94007856	MF-706
94-0482C	19:27394	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94007933	MF-940
94-0506C	19:27954	OSTI; NTIS; GPO Dep.	E 1.99:	DE94015801	MF-704
94-0544C	19:27298	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94015018	MF-722
94-0571C	19:27554	OSTI; NTIS; GPO Dep.	E 1.99:	DE94015786	MF-700
94-0572C	19:27536	*See* LA-UR–94-2236			
94-0624C	19:28039	OSTI; NTIS; GPO Dep.	E 1.99:	DE94014185	MF-706
94-0668C	19:27505	OSTI; NTIS; GPO Dep.	E 1.99:	DE94015738	MF-800
94-0759C	19:27555	OSTI; NTIS; GPO Dep.	E 1.99:	DE94015791	MF-700
94-0764C	19:27506	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94008923	MF-940
94-0784	19:28390	OSTI; NTIS; GPO Dep.	E 1.99:	DE94015531	MF-705
94-1068C	19:27556	OSTI; NTIS; GPO Dep.	E 1.99:	DE94015759	MF-706
94-1156C	19:28946	OSTI; NTIS; GPO Dep.	E 1.99:	DE94015761	
94-1175C	19:28040	OSTI; NTIS; GPO Dep.	E 1.99:	DE94010808	MF-700
94-1227C	19:28082	OSTI; NTIS; GPO Dep.	E 1.99:	DE94014660	MF-706
94-1244C	19:27794	OSTI; NTIS; GPO Dep.	E 1.99:	DE94013823	MF-706
94-1279	19:27933	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94015601	MF-1394
94-1305C	19:27934	OSTI; NTIS; GPO Dep.	E 1.99:	DE94015016	MF-704
94-1309C	19:27955	OSTI; NTIS; GPO Dep.	E 1.99:	DE94013449	MF-706
94-1316C	19:28083	OSTI; NTIS; GPO Dep.	E 1.99:	DE94014281	MF-706
94-1328C	19:27911	OSTI; NTIS; GPO Dep.	E 1.99:	DE94012072	MF-704
94-1351C	19:27557	OSTI; NTIS; GPO Dep.	E 1.99:	DE94015773	MF-706
94-1381C	19:28084	OSTI; NTIS; GPO Dep.	E 1.99:	DE94013437	MF-704
94-1383C	19:27865	OSTI; NTIS; GPO Dep.	E 1.99:	DE94014659	MF-705
94-1384C	19:28947	OSTI; NTIS; GPO Dep.	E 1.99:	DE94014662	MF-705
94-1436C	19:28085	OSTI; NTIS; GPO Dep.	E 1.99:	DE94015745	MF-706
94-1492C	19:27608	OSTI; NTIS; GPO Dep.	E 1.99:	DE94015284	MF-1290
94-1496C	19:28086	OSTI; NTIS; GPO Dep.	E 1.99:	DE94014282	MF-706
94-1503C	19:28087	OSTI; NTIS; GPO Dep.	E 1.99:	DE94014661	MF-700
94-1518C	19:27804	OSTI; NTIS; GPO Dep.	E 1.99:	DE94015276	MF-700
94-1552C	19:27852	OSTI; NTIS; GPO Dep.	E 1.99:	DE94015775	MF-700
94-1556C	19:28948	OSTI; NTIS; GPO Dep.	E 1.99:	DE94014284	MF-706
94-1582C	19:28949	OSTI; NTIS; GPO Dep.	E 1.99:	DE94015278	MF-700
94-1583C	19:28950	OSTI; NTIS; GPO Dep.	E 1.99:	DE94015277	MF-705
94-1614C	19:28379	OSTI; NTIS; GPO Dep.	E 1.99:	DE94015279	MF-742
94-1619C	19:28777	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94014182	MF-706
94-1629C	19:27935	OSTI; NTIS; GPO Dep.	E 1.99:	DE94015274	MF-704
94-1644C	19:27956	OSTI; NTIS; GPO Dep.	E 1.99:	DE94015012	MF-705
94-1669C	19:27936	OSTI; NTIS; GPO Dep.	E 1.99:	DE94016149	MF-404
94-1700C	19:28088	OSTI; NTIS; GPO Dep.	E 1.99:	DE94015019	MF-706
94-1712	19:28842	OSTI; NTIS; GPO Dep.	E 1.99:	DE94015780	MF-401
94-1715C	19:27791	OSTI; NTIS; GPO Dep.	E 1.99:	DE94014656	MF-706
94-1726C	19:27957	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94015765	MF-700
94-1748C	19:28580	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94015013	MF-414
94-1782C	19:28089	OSTI; NTIS; GPO Dep.	E 1.99:	DE94015282	MF-706
94-1796C	19:28951	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94015805	MF-705; MF-700
94-1825C	19:28090	OSTI; NTIS; GPO Dep.	E 1.99:	DE94015287	MF-706
94-1874C	19:28843	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94015017	MF-421
94-1888C	19:28091	OSTI; NTIS; GPO Dep.	E 1.99:	DE94015774	MF-704
94-1922C	19:27558	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94015794	MF-700
94-1923C	19:27299	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94015784	
94-1956C	19:28092	OSTI; NTIS; GPO Dep.	E 1.99:	DE94015895	MF-704
94-1977C	19:27559	OSTI; NTIS; GPO Dep.	E 1.99:	DE94015737	
94-2028C	19:28391	OSTI; NTIS; GPO Dep.	E 1.99:	DE94016554	MF-706
94-8002	19:27395	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94011627	MF-902
94-8227	19:28952	OSTI; NTIS; GPO Dep.	E 1.99:	DE94016480	MF-705
94-8241	19:27238	OSTI; NTIS; GPO Dep.	E 1.99:	DE94015781	MF-104
94-8616C	19:28380	OSTI; NTIS; GPO Dep.	E 1.99:	DE94015892	MF-700
94-8621	19:28041	OSTI; NTIS; GPO Dep.	E 1.99:	DE94015782	MF-406
94-8652C	19:27239	OSTI; NTIS; GPO Dep.	E 1.99:	DE94016614	MF-105
94-8653C	19:28473	OSTI; NTIS; GPO Dep.	E 1.99:	DE94016619	MF-902
94-8713C	19:28093	OSTI; NTIS; GPO Dep.	E 1.99:	DE94015716	MF-706
SCPRI-RM–					
2-1994	19:28501	OSTI; NTIS (US Sales Only); INIS		DE94632185	

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
SD-WM-TI–					
131	19:27396	OSTI; NTIS; GPO Dep.	E 1.99:	DE94016432	MF-510
SD-WM-TP–					
30	19:27397	OSTI; NTIS; GPO Dep.	E 1.99:	DE94016433	MF-902
SEASF-TR–					
91-008	19:28395	*See* LA-SUB–94-43			
SLAC–					
443	19:28605	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94016583	PC-414
SNV–					
4299	19:27810	OSTI; NTIS		DE94783396	
4300	19:27811	OSTI; NTIS		DE94783397	
4301	19:27812	OSTI; NTIS		DE94783398	
4302	19:27813	OSTI; NTIS		DE94783399	
SR/EMEU–					
94-01	19:27853	OSTI; NTIS; GPO; GPO Dep.	E 1.99:	DE94015395	MF-950
SR/H–					
695	19:27398	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE94009151	MF-706
721	19:27483	*See* DPW–55-131			
722	19:27684	*See* DPW–53-1355			
746	19:27274	OSTI; NTIS; GPO Dep.	E 1.99:	DE94014642	MF-706
747	19:27753	OSTI; NTIS; GPO Dep.	E 1.99:	DE94014643	MF-706
748	19:27754	OSTI; NTIS; GPO Dep.	E 1.99:	DE94014644	MF-700
749	19:27755	OSTI; NTIS; GPO Dep.	E 1.99:	DE94014645	MF-700
750	19:27756	OSTI; NTIS; GPO Dep.	E 1.99:	DE94015372	MF-700
759	19:27757	OSTI; NTIS; GPO Dep.	E 1.99:	DE94015705	MF-700
761	19:27758	OSTI; NTIS; GPO Dep.	E 1.99:	DE94016250	MF-706
767	19:27994	*See* DPW–56-135			
769	19:27673	*See* DPW–56-179			
STUK-A–					
114	19:28474	OSTI; NTIS; INIS		DE94632227	
94	19:28522	OSTI; NTIS; INIS		DE94632216	
STUK-B-YTO–					
116	19:27651	OSTI; NTIS; INIS		DE94632660	
STUK/ST-GUIDE–					
1.4	19:28563	OSTI; NTIS; INIS		DE94632369	
1.7	19:28564	OSTI; NTIS; INIS		DE94632378	
12.1	19:28566	OSTI; NTIS; INIS		DE94632379	
5.3	19:28565	OSTI; NTIS; INIS		DE94632370	
STUK/YVL-GUIDE–					
1.9	19:27638	OSTI; NTIS; INIS		DE94632643	
2.5	19:27639	OSTI; NTIS; INIS		DE94632644	
3.7	19:27666	OSTI; NTIS; INIS		DE94632608	
7.1	19:27682	OSTI; NTIS; INIS		DE94632359	
8.2	19:27399	OSTI; NTIS; INIS		DE94632827	
SVF–					
498	19:27579	OSTI; NTIS		DE94783401	
TA–					
308	19:27839	*See* LBL–33192			
TD–					
2089	19:28399	*See* PNL–9818			
THAI-AEC–					
15	19:28543	OSTI; NTIS (US Sales Only); INIS		DE94632344	
18	19:28544	OSTI; NTIS (US Sales Only); INIS		DE94632345	
TPS–					
94-4	19:27577	OSTI; NTIS		DE94783395	
TR–					
5146-1	19:27481	*See* DOE/RL/10930–T2			
TRI-PP–					
89-49	19:28658	OSTI; NTIS (US Sales Only); INIS		DE94633191	
89-55	19:28659	OSTI; NTIS (US Sales Only); INIS		DE94633192	
89-56	19:28660	OSTI; NTIS (US Sales Only); INIS		DE94633193	
89-57	19:28661	OSTI; NTIS (US Sales Only); INIS		DE94633194	
89-58	19:28739	OSTI; NTIS (US Sales Only); INIS		DE94633333	
89-59	19:28740	OSTI; NTIS (US Sales Only); INIS		DE94633334	
89-60	19:28741	OSTI; NTIS (US Sales Only); INIS		DE94633335	
89-61	19:28621	OSTI; NTIS (US Sales Only); INIS		DE94633139	
89-62	19:28742	OSTI; NTIS (US Sales Only); INIS		DE94633336	
89-64	19:28768	OSTI; NTIS (US Sales Only); INIS		DE94633369	
89-66	19:28743	OSTI; NTIS (US Sales Only); INIS		DE94633286	
90-9	19:28701	OSTI; NTIS (US Sales Only); INIS		DE94633260	
90-10	19:28744	OSTI; NTIS (US Sales Only); INIS		DE94633297	

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
90-11	19:28662	OSTI; NTIS (US Sales Only); INIS		DE94633195	
90-12	19:28663	OSTI; NTIS (US Sales Only); INIS		DE94633182	
90-14	19:28664	OSTI; NTIS (US Sales Only); INIS		DE94633204	
90-17	19:28745	OSTI; NTIS (US Sales Only); INIS		DE94633316	
90-18	19:28746	OSTI; NTIS (US Sales Only); INIS		DE94633317	
90-19	19:28678	OSTI; NTIS (US Sales Only); INIS		DE94633218	
91-4	19:28747	OSTI; NTIS (US Sales Only); INIS		DE94633298	
91-6	19:28339	OSTI; NTIS (US Sales Only); INIS		DE94632799	
91-7	19:28119	OSTI; NTIS (US Sales Only); INIS		DE94632515	
91-9	19:28702	OSTI; NTIS (US Sales Only); INIS		DE94633262	
91-10	19:28665	OSTI; NTIS (US Sales Only); INIS		DE94633197	
91-11	19:28666	OSTI; NTIS (US Sales Only); INIS		DE94633198	
91-12	19:28703	OSTI; NTIS (US Sales Only); INIS		DE94633261	
91-13	19:28340	OSTI; NTIS (US Sales Only); INIS		DE94632797	
91-14	19:28341	OSTI; NTIS (US Sales Only); INIS		DE94632798	
91-15	19:28147	OSTI; NTIS (US Sales Only); INIS		DE94632520	
91-16	19:28148	OSTI; NTIS (US Sales Only); INIS		DE94632521	
91-17	19:28247	OSTI; NTIS (US Sales Only); INIS		DE94632558	
91-18	19:28248	OSTI; NTIS (US Sales Only); INIS		DE94632559	
91-19	19:28249	OSTI; NTIS (US Sales Only); INIS		DE94632560	
91-20	19:28250	OSTI; NTIS (US Sales Only); INIS		DE94632561	
91-21	19:28251	OSTI; NTIS (US Sales Only); INIS		DE94632562	
91-22	19:28252	OSTI; NTIS (US Sales Only); INIS		DE94632563	
91-23	19:28149	OSTI; NTIS (US Sales Only); INIS		DE94632522	
91-24	19:28253	OSTI; NTIS (US Sales Only); INIS		DE94632542	
91-25	19:28120	OSTI; NTIS (US Sales Only); INIS		DE94632513	
91-26	19:28254	OSTI; NTIS (US Sales Only); INIS		DE94632549	
91-27	19:28255	OSTI; NTIS (US Sales Only); INIS		DE94632564	
91-28	19:28256	OSTI; NTIS (US Sales Only); INIS		DE94632550	
91-29	19:28121	OSTI; NTIS (US Sales Only); INIS		DE94632514	
91-30	19:28257	OSTI; NTIS (US Sales Only); INIS		DE94632543	
91-31	19:28258	OSTI; NTIS (US Sales Only); INIS		DE94632544	
91-32	19:28259	OSTI; NTIS (US Sales Only); INIS		DE94632565	
91-33	19:28260	OSTI; NTIS (US Sales Only); INIS		DE94632551	
91-34	19:28104	OSTI; NTIS (US Sales Only); INIS		DE94632506	
91-35	19:28261	OSTI; NTIS (US Sales Only); INIS		DE94632566	
91-36	19:28262	OSTI; NTIS (US Sales Only); INIS		DE94632530	
91-37	19:28263	OSTI; NTIS (US Sales Only); INIS		DE94632552	
91-38	19:28264	OSTI; NTIS (US Sales Only); INIS		DE94632567	
91-39	19:28265	OSTI; NTIS (US Sales Only); INIS		DE94632531	
91-40	19:28266	OSTI; NTIS (US Sales Only); INIS		DE94632553	
91-41	19:28105	OSTI; NTIS (US Sales Only); INIS		DE94632507	
91-42	19:28267	OSTI; NTIS (US Sales Only); INIS		DE94632554	
91-43	19:28622	OSTI; NTIS (US Sales Only); INIS		DE94633140	
91-44	19:28667	OSTI; NTIS (US Sales Only); INIS		DE94633175	
92-13	19:28122	OSTI; NTIS (US Sales Only); INIS		DE94632516	
UCB-PTH–					
94/09	19:28619	*See* LBL–35530			
UCRL–					
21215-94-Rev.1	19:27400	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94015872	MF-702
UCRL-CR–					
116576	19:27476	*See* DOE/MWIP–27			
117234	19:27937	OSTI; NTIS; GPO Dep.	E 1.99:	DE94016172	MF-404
117459	19:28342	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94016175	MF-414
117775	19:28042	OSTI; NTIS; GPO Dep.	E 1.99:	DE94015181	MF-900
118201	19:28373	OSTI; NTIS; GPO Dep.	E 1.99:	DE94016704	MF-700
UCRL-ID–					
115057	19:28894	OSTI; NTIS; GPO Dep.	E 1.99:	DE94015355	MF-702
115386	19:28004	OSTI; NTIS; GPO Dep.	E 1.99:	DE94007762	MF-700
115393	19:28502	OSTI; NTIS; GPO Dep.	E 1.99:	DE94012585	MF-703
115754	19:27401	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94012587	MF-940
116939	19:28400	OSTI; NTIS; GPO Dep.	E 1.99:	DE94016628	MF-706
117011	19:27402	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94015879	MF-721
117079	19:28094	OSTI; NTIS; GPO Dep.	E 1.99:	DE94016416	MF-700
117250	19:28381	OSTI; NTIS; GPO Dep.	E 1.99:	DE94016008	MF-701
117334	19:28879	OSTI; NTIS; GPO Dep.	E 1.99:	DE94016009	MF-712
117435	19:27958	OSTI; NTIS; GPO Dep.	E 1.99:	DE94016485	MF-700
117530	19:27912	OSTI; NTIS; GPO Dep.	E 1.99:	DE94015946	MF-704
117543	19:28503	OSTI; NTIS; GPO Dep.	E 1.99:	DE94016010	MF-703
117546	19:27913	OSTI; NTIS; GPO Dep.	E 1.99:	DE94016011	MF-704
117549	19:28382	OSTI; NTIS; GPO Dep.	E 1.99:	DE94016012	MF-700

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
117550	19:28523	OSTI; NTIS; GPO Dep.	E 1.99:	DE94016013	MF-700
117583	19:28383	OSTI; NTIS; GPO Dep.	E 1.99:	DE94016482	MF-700
117603	19:27578	OSTI; NTIS; GPO Dep.	E 1.99:	DE94016483	MF-1414
117785	19:28095	OSTI; NTIS; GPO Dep.	E 1.99:	DE94016633	MF-706
117787	19:28384	OSTI; NTIS; GPO Dep.	E 1.99:	DE94016486	MF-706
117796	19:28758	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94016487	MF-700
117797	19:28748	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94016488	MF-700
118200	19:28398	OSTI; NTIS; GPO Dep.	E 1.99:	DE94016634	MF-700
UCRL-JC–					
113790-Rev.2	19:28504	OSTI; NTIS; GPO Dep.	E 1.99:	DE94011757	MF-902
114326-Rev.1	19:28761	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94015190	MF-701
114776	19:27403	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94008966	MF-814
114938	19:28595	OSTI; NTIS; GPO Dep.	E 1.99:	DE94014735	MF-700
114954	19:28096	OSTI; NTIS; GPO Dep.	E 1.99:	DE94015139	MF-706
115069	19:28970	OSTI; NTIS; GPO Dep.	E 1.99:	DE94014747	MF-702
115076	19:28475	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94014749	MF-940
115149	19:28097	OSTI; NTIS; GPO Dep.	E 1.99:	DE94015138	MF-712
115511	19:28098	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94015142	MF-706
115599	19:28880	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94016449	MF-712
115712-Rev.1	19:28099	OSTI; NTIS; GPO Dep.	E 1.99:	DE94015561	MF-706
115839	19:27815	OSTI; NTIS; GPO Dep.	E 1.99:	DE94014794	MF-705
116175-Rev.1	19:28534	OSTI; NTIS; GPO Dep.	E 1.99:	DE94015143	MF-700
116212	19:28844	OSTI; NTIS; GPO Dep.	E 1.99:	DE94015140	MF-700
116227	19:28953	OSTI; NTIS; GPO Dep.	E 1.99:	DE94015722	MF-705
116229	19:28954	OSTI; NTIS; GPO Dep.	E 1.99:	DE94010204	MF-705
116231	19:28955	OSTI; NTIS; GPO Dep.	E 1.99:	DE94010205	MF-705
116238	19:28956	OSTI; NTIS; GPO Dep.	E 1.99:	DE94014750	MF-405
116309	19:28100	OSTI; NTIS; GPO Dep.	E 1.99:	DE94015323	MF-706
116350	19:27404	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94014788	MF-814
116416	19:27959	OSTI; NTIS; GPO Dep.	E 1.99:	DE94013233	MF-403
116424	19:28971	OSTI; NTIS; GPO Dep.	E 1.99:	DE94014740	MF-704
116428	19:28397	OSTI; NTIS; GPO Dep.	E 1.99:	DE94014739	MF-742
116437	19:28571	OSTI; NTIS; GPO Dep.	E 1.99:	DE94014742	MF-903
116440	19:27960	OSTI; NTIS; GPO Dep.	E 1.99:	DE94014744	MF-904
116572	19:28505	OSTI; NTIS; GPO Dep.	E 1.99:	DE94016455	MF-402
116618	19:28957	OSTI; NTIS; GPO Dep.	E 1.99:	DE94014793	MF-405
116641	19:28958	OSTI; NTIS; GPO Dep.	E 1.99:	DE94015456	MF-705
116742	19:28101	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94015141	MF-712
116773	19:27866	OSTI; NTIS; GPO Dep.	E 1.99:	DE94014736	MF-900
116823	19:28102	OSTI; NTIS; GPO Dep.	E 1.99:	DE94015899	MF-712
117191	19:28374	OSTI; NTIS; GPO Dep.	E 1.99:	DE94015180	MF-706
117248	19:27795	OSTI; NTIS; GPO Dep.	E 1.99:	DE94014734	MF-904
117404	19:28881	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94015326	MF-706
117410	19:27914	OSTI; NTIS; GPO Dep.	E 1.99:	DE94015715	MF-704
117434	19:28366	OSTI; NTIS; GPO Dep.	E 1.99:	DE94015324	MF-700
117450	19:27567	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94015191	MF-900
117460	19:28734	*See* LA-UR–94-1907			
117461	19:28749	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94016360	MF-413
117462	19:28750	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94016357	MF-413
117464	19:28759	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94016359	MF-940
117466	19:28706	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94016176	MF-413
117468	19:28751	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94016356	MF-940
117470	19:28882	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94015189	MF-700
117488	19:28103	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94016446	MF-700
117503	19:28572	OSTI; NTIS; GPO Dep.	E 1.99:	DE94015136	MF-403
117504	19:27938	OSTI; NTIS; GPO Dep.	E 1.99:	DE94016598	MF-404
117523	19:28764	OSTI; NTIS; GPO Dep.	E 1.99:	DE94015137	MF-700
117704	19:28535	OSTI; NTIS; GPO Dep.	E 1.99:	DE94015179	MF-900
UCRL-LR–					
116938	19:28765	OSTI; NTIS; GPO Dep.	E 1.99:	DE94015327	MF-700
117409	19:28883	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94015170	MF-712
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115604	19:28959	OSTI; NTIS; GPO Dep.	E 1.99:	DE94015721	MF-905
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94-54	19:27405	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94017061	MF-814
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93-4144	19:27406	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94015008	MF-814
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0407-Rev.2	19:27507	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94016473	MF-900; MF-940

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0474-13	19:27407	OSTI; NTIS; GPO Dep.	E 1.99:	DE94016463	MF-940
0513	19:27509	OSTI; NTIS; GPO Dep.	E 1.99:	DE94015336	MF-902
0711	19:27408	OSTI; NTIS; GPO Dep.	E 1.99:	DE94016479	MF-900
0722-Add.2	19:27510	OSTI; NTIS; GPO Dep.	E 1.99:	DE94011337	MF-900
0722-Add.3-Draft	19:27511	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94015662	MF-902
0729	19:27409	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94016478	MF-902; MF-940
0743	19:27512	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94016459	MF-902
0767-Rev.1	19:27410	OSTI; NTIS; GPO Dep.	E 1.99:	DE94014632	MF-900
0769	19:27411	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94015661	MF-940
0772	19:27513	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94016475	MF-902
0780	19:27412	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94016458	MF-940
0784	19:27413	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94016470	MF-902
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0463	19:27414	OSTI; NTIS; GPO Dep.	E 1.99:	DE94015332	MF-900
WHC-SA–					
2016	19:27415	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94015755	MF-940
2261	19:27915	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94015711	MF-530
2277	19:27667	OSTI; NTIS; GPO Dep.	E 1.99:	DE94015639	MF-600
2278	19:27462	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94016321	MF-902
2284	19:28506	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94015640	MF-902
2313	19:27854	OSTI; NTIS; GPO Dep.	E 1.99:	DE94015709	MF-906
2317	19:27416	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94015707	MF-940
2335	19:27417	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94014629	MF-940
2358	19:28507	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94015669	MF-902; MF-940
2388	19:27514	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94011334	MF-902
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2433	19:27419	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94014636	MF-940
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242	19:27519	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94015754	MF-903; MF-940
245	19:27520	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94015672	MF-902
264	19:27521	OSTI; NTIS; GPO Dep.	E 1.99:	DE94015636	MF-630
265	19:28509	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94015335	MF-903
266	19:27985	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94015329	MF-903
267	19:27467	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94015645	MF-903
279	19:27522	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94015649	MF-940
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049	19:27523	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94015752	MF-940
WHC-SD-NR-TI–					
053	19:27524	OSTI; NTIS; GPO Dep.	E 1.99:	DE94015644	MF-506
WHC-SD-WM-PTR–					
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1162	19:27429	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94013805	MF-940
1206	19:27430	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94015532	MF-940
1218	19:28043	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94016421	MF-940
1219	19:27918	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94015783	MF-940
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94/15/MAR-PH	19:28631	*See* DESY–94-035			
WSRC-MS–					
93-412	19:27431	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94015547	MF-721
94-0102	19:27560	OSTI; NTIS; GPO Dep.	E 1.99:	DE94015555	MF-700
94-0106	19:27561	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94015590	MF-706
94-0107	19:27525	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94015589	MF-731
94-0110	19:27433	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94015569	MF-731
94-0112	19:28960	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94015566	MF-700
94-0113	19:28510	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94015568	MF-702
94-0130	19:27635	OSTI; NTIS; GPO Dep.	E 1.99:	DE94011673	MF-721
94-0133	19:27434	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94015565	MF-721
94-0153P	19:28961	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94015557	MF-700
94-0163	19:27435	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94015838	MF-721
94-027	19:27432	OSTI; NTIS; GPO Dep.	E 1.99:	DE94015554	MF-701
94-0274	19:27436	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94014863	MF-721
94-0328	19:27437	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94014651	MF-721
94-0331	19:27438	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94014650	MF-721
94-0341	19:28962	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94015548	MF-721
94-0352	19:27760	OSTI; NTIS; GPO Dep.	E 1.99:	DE94014870	MF-706
94-0383	19:28268	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94015832	MF-706
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93-682	19:27762	OSTI; NTIS; GPO Dep.	E 1.99:	DE94015492	MF-706
93-683	19:27781	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94015493	MF-706
93-684	19:27782	OSTI; NTIS; GPO Dep.	E 1.99:	DE94015496	MF-706
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YE Yemen, Republic of
YU Yugoslavia

ZA South Africa
ZM Zambia
ZR Zaire
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ED EANDC [European American Nuclear Data Committee]
EP European Patent Office
IO ILO [International Labor Organization]
IX IUPAC [International Union of Pure and Applied Chemistry]
QS INSPEC [Information Service in Physics, Electrotechnology and Control]
QZ INPADOC [International Patent Document Centre]
WO WIPO [World Intellectual Property Organization]
XA IAEA [International Atomic Energy Agency]
XC CERN [European Organization for Nuclear Research]
XD OECD [Organization for Economic Co-Operation and Development]
XE CEC [Commission of the European Communities]
XF FAO [Food and Agricultural Organization of the United Nations]
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Madison, WI 53706
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WYOMING STATE LIBRARY
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